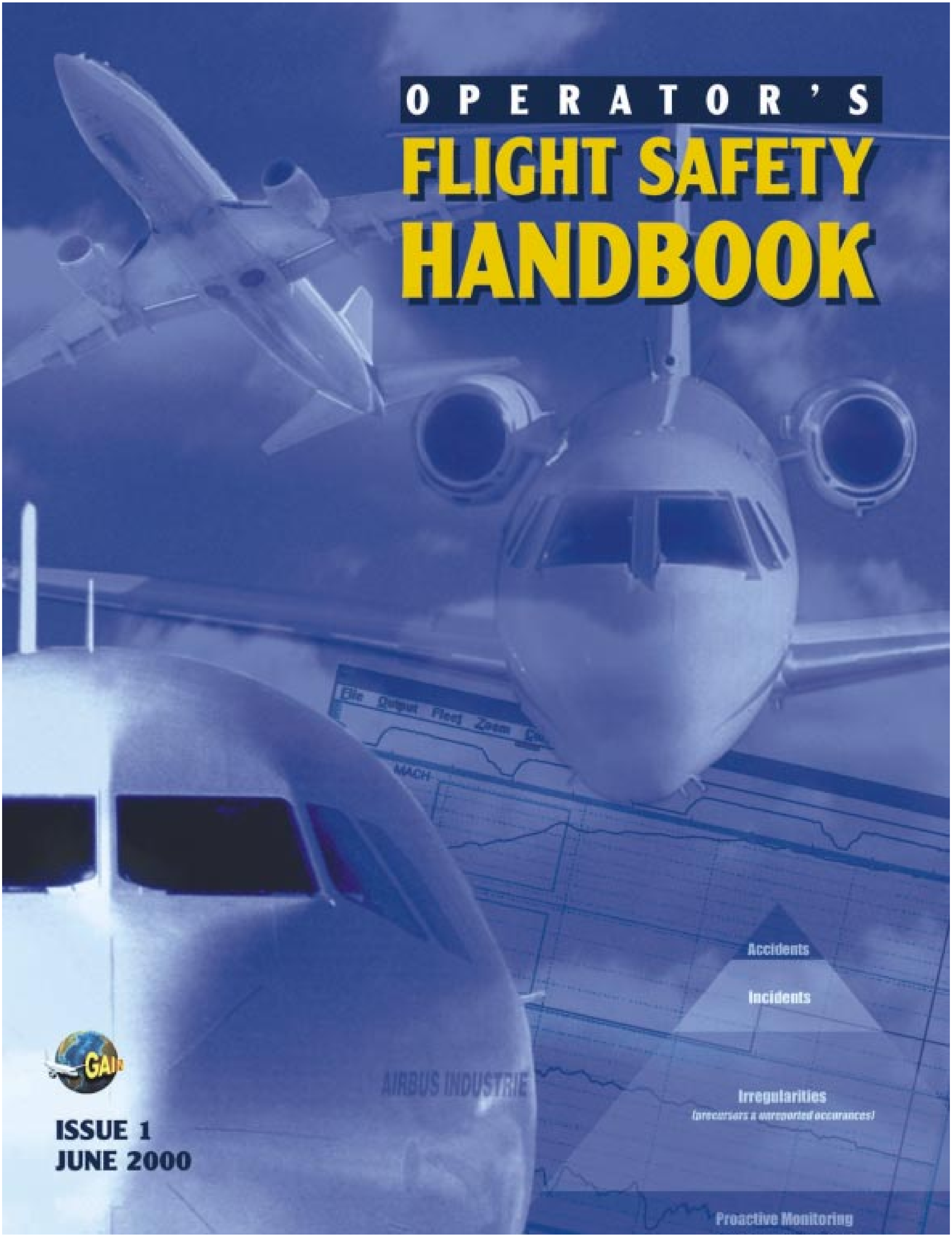
OPERATOR'S FLIGHT SAFETY HANDBOOK



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JUNE 2000

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CEO STATEMENT ON

CORPORATE SAFETY CULTURE COMMITMENT

CORE VALUES

Among our core values, we will include:

- Safety, health and the environment
- Ethical behaviour
- Valuing people

FUNDAMENTAL BELIEFS

Our fundamental safety beliefs are:

- Safety is a core business and personal value
- Safety is a source of our competitive advantage
- We will strengthen our business by making safety excellence an integral part of all flight and ground activities
- We believe that all accidents and incidents are preventable
- All levels of line management are accountable for our safety performance, starting with the Chief Executive Officer (CEO)/Managing Director

CORE ELEMENTS OF OUR SAFETY APPROACH

The five core elements of our safety approach include:

Top Management Commitment

- Safety excellence will be a component of our mission
- Senior leaders will hold line management and all employees accountable for safety performance
- Senior leaders and line management will demonstrate their continual commitment to safety

Responsibility & Accountability of All Employees

- Safety performance will be an important part of our management/employee evaluation system
- We will recognise and reward flight and ground safety performance
- Before any work is done, we will make everyone aware of the safety rules and processes as well as their personal responsibility to observe them

Clearly Communicated Expectations of Zero Incidents

- We will have a formal written safety goal, and we will ensure everyone understands and accepts that goal
- We will have a communications and motivation system in place to keep our people focused on the safety goal

Auditing & Measuring for Improvement

- Management will ensure regular conduct safety audits are conducted and that everyone will participate in the process
- We will focus our audits on the behaviour of people as well as on the conditions of the operating area
- We will establish both leading and trailing performance indicators to help us evaluate our level of safety

Responsibility of All Employees

- Each one of us will be expected to accept responsibility and accountability for our own behaviour
- Each one of us will have an opportunity to participate in developing safety standards and procedures
- We will openly communicate information about safety incidents and will share the lessons with others
- Each of us will be concerned for the safety of others in our organisation

THE OBJECTIVES OF THE SAFETY PROCESS

- **ALL** levels of management will be clearly committed to safety.
- We will have clear employee safety metrics, with clear accountability.
- We will have open safety communications.
- We will involve everyone in the decision process.
- We will provide the necessary training to build and maintain meaningful ground and flight safety leadership skills.
- **The safety of our employees, customers and suppliers will be a Company strategic issue.**

(Signed)
CEO/Managing Director/or as appropriate

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FOREWORD

ACKNOWLEDGEMENT OF CONTRIBUTORS

The GAIN Programme would like to especially recognise the contribution by Airbus Industrie, whose "*Flight Safety Manager's Handbook*" was used as the foundation for this document. The GAIN Programme would also like to gratefully acknowledge the efforts of all the members of Working Group A, Aviation Operators Safety Practices, in the development of this document, as well as the following organisations for their outstanding dedication to improving aviation safety through the development of this handbook and/or contribution of source material.

Developers & Contributors:

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Independent & Corporate/Academic Review Team Members:

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PROLOGUE

LAYOUT OF THE MANUAL

P.1 PARAGRAPH NUMBERING

P.1.1 A decimal section and paragraph numbering system is used for ease of reference. A List of Sections and an alphabetical index of subjects is provided.

P.2 HEADINGS & EMPHASIS

P.2.1 Main headings are displayed in **BLUE/BOLD CAPITALS**. Sub headings and statements/notes requiring emphasis appear in **Blue/Bold Upper** and **Lower Case** letters.

P.3 POSITION NAMES & TITLES

P.3.1 The terms used for position names and/or titles are typical and commonly found within the aviation industry. These terms may vary among various operators.

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SECTION 1 - INTRODUCTION

1.1 OBJECTIVE

1.1.1 This handbook is intended to serve as a guide for the creation and operation of a flight safety function within an operator's organisation. This handbook is specifically oriented and focused on the impact of safety considerations as they apply to air operations. It also acknowledges the importance of the development of safety practices in all areas of the organisation. The handbook also includes reference and guidance to areas that may not have been historically included in the safety department, such as Emergency Response and Crisis Management. The Working Group strongly emphasises the importance of independence and authority of the safety function in each organisation. Recognising that the final structure of the safety element will reflect the culture of the organisation, the Working Group urges that the Flight Safety Officer report directly to the Chief Executive Officer (CEO) and be empowered to positively effect safety integration throughout the organisation.

1.1.2 The overall objective of the Global Aviation Information Network (GAIN) Programme is to promote and facilitate the voluntary collection and sharing of safety information by and among users in the international aviation community.

1.2 BACKGROUND

1.2.1 This *Operator's Flight Safety Handbook* was developed by the Aviation Operator's Safety Practices Working Group of the Global Aviation Information Network (GAIN) initiative as a derivation of the Airbus Industrie *Flight Safety Manager's Handbook*. This document has been developed by subject matter experts from the organisations listed in the Foreword of this document as necessary to be compatible with the philosophy, practices, and procedures of the organisation. Where possible, alternative practices and procedures in current use are also shown. This is *not* a regulatory-approved document and its contents do not supersede any requirements mandated by the State of Registry of the operator's aircraft, nor does it supersede or amend the manufacturer's type-specific aeroplane flight manuals, crew manuals, minimum equipment lists, or any other approved documentation. This handbook is provided for guidance purposes only. The Working Group does not accept any liability whatsoever for incidents arising from the use of the guidance contained in this document.

1.2.2 The important elements of an effective safety programme are:

- Senior management commitment to the company safety programme
- Appointment of a Flight Safety Officer reporting directly to the CEO
- Encouragement of a positive safety culture
- Establishment of a safety management structure
- Hazard identification and risk management
- On-going hazard reporting system
- Safety audits and assessment of quality or compliance

- Accident and incident reporting and investigation
- Documentation
- Immunity-based reporting systems
- Implementation of a Digital Flight Data Recorder information collection system
- The exchange of valuable “Lessons Learned” with manufactures and other airlines
- Safety training integration into the organisation's training syllabi
- Human factors training for all personnel
- Emergency response planning
- Regular evaluation and ongoing fine tuning of the programme

1.2.3 For further information or to submit comments and/or suggestions related to this handbook, please contact:

GAIN Aviation Operator Safety Practices Working Group
Email: GAINweb@abacustech.com
http://www.gainweb.org

1.2.4 This handbook should be read, where appropriate, in conjunction with:

- The Airbus Industrie Operations Policy Manual, Chapters 2.03 (Accident Prevention) and 11.00 (Handling of Accidents and Occurrences)
- Boeing’s Safety Program Model
- JAR-OPS 1 (European Joint Aviation Regulations - Commercial Air Transport [Aeroplanes]) and JAR 145 (Maintenance)
- United States Federal Regulations in all parts applicable to the type of operation
- The ICAO Convention relevant annexes
- The operator’s own Operations Policy Manuals/Flight Operations Manual, as appropriate

1.3 SCOPE

1.3.1 The methods and procedures described in this handbook have been compiled from experience gained in the successful development and management of flight safety programmes in commercial airlines and corporate and cargo operations, as well as proven resources from governments, manufacturers and various other aviation organisations.

1.3.2 The aim of this handbook is to assist an operator in developing an effective safety programme and/or allow an existing flight safety organisation to further refine and improve its existing programme.

SECTION 2 - ORGANISATION & ADMINISTRATION

Note: This handbook is intended to serve as a guide for the creation and operation of a flight safety function within the structure of an operator's organisation. The Working Group is fully cognisant that the final structure of the safety element will reflect the culture of the organisation, but the Flight Safety Officer must be empowered to positively effect safety integration within this structure.

2.1 EXECUTIVE COMMITMENT

2.1.1 A safety programme is essentially a co-ordinated set of procedures for effectively managing the safety of an operation. It is more than just safe operating practices. It is a total management programme. Top management sets the safety standards. The Chief Executives or managers should:

- Specify the company's standards
- Ensure that everyone knows the standards and accepts them
- Make sure there is a system in place so that deviations from the standard are recognised, reported, and corrected.

2.1.2 The Company must maintain its standards through the support of the Flight Safety department. This requires that the staff are involved in developing the standards, responsibilities are made clear, and all staff consistently work to the standards.

The ultimate responsibility for safety rests with the directors and management of the Company. The Company's attitude to safety—the Company's *safety culture*—is established from the outset by the extent to which senior management accepts responsibility for safe operations, particularly the proactive management of risk. Regardless of the size, complexity, or type of operation, senior management determines the Company's safety culture. However, without the wholehearted commitment of all personnel, any safety programme is unlikely to be effective.

2.1.3 There will always be hazards, both real and potential, associated with the operation of any aircraft. Technical, operational and human failures induce the hazards. The aim of every flight safety programme therefore is to address and control them. This is achieved through the establishment of a safety programme (refer to Section 3) which ensures the careful recording and monitoring of safety-related occurrences for adverse trends in order to prevent the recurrence of similar incidents which could lead to an aircraft accident.

2.1.4 In some States the regulatory authority may require any commercial aircraft operator to nominate an individual to co-ordinate the Company's flight safety programme. This task is sometimes allocated to a pilot, flight engineer or ground engineer who acts in the capacity of Flight Safety Officer as a secondary duty. The effectiveness of this arrangement can vary, depending on the amount of time available to carry out the secondary duty and the operational style of the Company. It is best accomplished by the appointment of a full-time Flight Safety Officer whose responsibility is to promote safety awareness and ensure that the prevention of aircraft accidents is the priority throughout all divisions and departments in the organisation.

2.1.5 The Company's Policy Manual should contain a signed statement by the accountable manager (usually the CEO) which specifies the Company's safety commitment in order to give the manual credence and validation

2.2 ELEMENTS OF A SAFETY MANAGEMENT SYSTEM

2.2.1 Management Commitment

2.2.1.1 An operator's commitment to safety is reflected in corporate values, mission, strategy, goals and policy. Ultimate responsibility, authority and accountability for the safety management process lie with the Chairman, President and Chief Executive Officer (CEO). Each divisional vice president has the final responsibility, authority, and accountability for the safety process in their division. The responsibility, authority, and accountability to carry out the daily safety function are managed by this officer along organisational lines within the department(s) or by special assignment. Corporate workplace safety and health management is accomplished using the following mechanisms and recognised business practices:

- The three-year strategic business planning process, i.e. mission, strategies, goals, and initiatives
- The annual business and operating plan process
- The establishment of specific safety performance measurements by each operating division.
- Inclusion of safety responsibility in each manager's job description and performance review.
- Naming of specific individuals responsible to achieve divisional/departmental safety initiatives.
- Requiring each location within an operational division to develop, maintain and implement a written Workplace Safety Business Plan.
- Establishing procedures that address the location's contractor exposures.
- Establishing a continuous improvement process, which utilises a safety team or safety improvement team format within each operational division.

2.2.2 Employee Requirements/Action

2.2.2.1 Each employee is responsible and personally accountable for:

- Performing only those technical functions for which they are trained
- Observing/following/supporting established safety and health policies, practices, procedures and operational requirements
- Notifying management of unsafe conditions directly or through anonymous procedures; other divisional and local methods are encouraged
- Operating only that equipment on which they have been trained and are qualified to operate
- Using required personal protective equipment as trained
- Availing oneself of safety and health training
- Following the established procedures to acquire, use and dispose of chemicals
- Keeping work areas free of recognised hazards

- Reporting occupational injuries and illnesses and aircraft damage in accordance with Company policy

2.2.3 Corporate Safety Responsibilities

2.2.3.1 The Corporate Safety group is responsible for ensuring that the safety and health management process is established, communicated, implemented, audited, measured and continuously improved for the corporation and divisional key customers. This will be accomplished via the following:

- Preparing and maintaining a Corporate Safety Manual
- Serving as a safety and health resource for all operational divisions and employees
- Assisting with the organisation/development of written Workplace Safety Business Plans
- Assisting with the three-year and annual divisional planning processes, e.g., safety performance goals
- Maintaining the official Company safety management information database
- Providing human factors expertise and program development
- Providing consulting services on regulatory compliance issues
- Providing ergonomics consulting and workplace safety training
- Providing regular safety communication through corporate and divisional news media
- Providing industrial hygiene services
- Establish and maintain the chemical safety management process
- Support continuous safety improvement programs
- Provide emergency management tools and consulting services
- Maintain operating business partner safety relationships

Important Note*: *Within an operator's organisation, the complimentary but different aspects of Flight Safety (including airworthiness) and Health and Safety management must both be considered. Many of the principles of safety management are common to both areas, but this document deals with flight safety only.

2.2.3.2 Managers can only achieve their results through the efforts of their staff. An effective safety management system requires commitment from both the staff and management, but this can only be achieved if the managers provide the necessary leadership and motivation. This is true at all levels of management, but it is essential that the process is led by the CEO. The management's commitment to safety is fundamental and must be readily visible at all levels. Every opportunity for actively demonstrating this commitment to safety should be taken.

2.2.3.3 Safety management standards should be set which clearly allocate responsibilities. To provide a focus for the detail of the safety management system, a senior manager, (the custodian of the system), should be tasked with this responsibility and trained in safety management to provide guidance in the development of the safety programme. Monitoring of performance levels against the agreed standards is vital to ensure that the objectives are achieved. Managers should set a positive example in safety matters at all times.

2.2.3.4 Continued reduction in accidents and serious incidents has been achieved by companies that lead the world in safety management and which have adopted safe working procedures. Safe working procedures must be combined with disciplined behaviour to minimise accidents and serious incidents. Sustained leadership and motivation is required to achieve this often difficult aim. Effective leadership at all levels of management can focus the attention of all employees on the need to develop the right attitude and pride in the safe operation of the Company.

2.2.4 Safety Management Policy Document

2.2.4.1 This document should be customised and signed by the CEO or Managing Director and may be integrated within the Quality Manual. The document should include:

Company Safety Principles
- Safety Objectives
- Arrangements for the achievement of Safety Objectives
- Flight Safety Policy
- Health and Safety Policy
- Quality Policy
- Corporate and Safety Standards

Provisions of Flight Safety Services
- Management responsibilities
- Production of Safety Cases
- Review, Verification and Revision of Safety Cases with changing structure of business
- Regular provision of information to the Board and Management
- Monitoring and Auditing of Safety
- Safety Management Guide
- Initial and Recurrent Training
- Improvement of Safety Culture
- Emergency Planning
- Ownership and Liabilities
- Director’s responsibilities
- Interface with the regulatory authorities
- Third Party Liabilities

Arrangements for technical support
- Use of contractors

2.3 *ORGANIZATIONAL STRUCTURES*

2.3.1 Accountable Manager - Definition

The person acceptable to the State’s regulatory authority who has corporate authority for ensuring that all operations and maintenance activities can be financed and carried out to the standard required by the Authority, and any additional requirements defined by the operator.

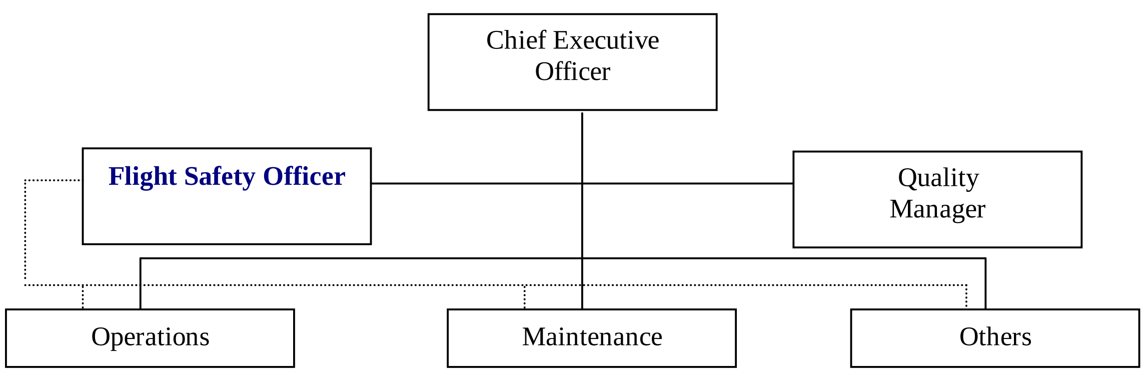
2.3.1.1 The responsibilities and authority of the Flight Safety Officer and the Chief Pilot must be clear and understood to prevent conflict. The Flight Safety Officer should report directly to the CEO. However, it is essential that the Chief Pilot's position is not undermined in the process. Senior level management needs to identify any potential problem and promulgate clear policy to maintain the integrity of the Safety Program and avert any conflict.

2.3.1.2 Ideally, the Flight Safety Officer should report directly to the CEO on all safety matters, because in this way safety reports and recommendations can be assured of the proper level of study, assessment and implementation. The Flight Safety Officer needs to have the CEO's support and trust in order to effectively discharge his responsibilities without fear of retribution.

2.3.2 <u>Examples of Flight Operations Management Organisation</u>:

In order to interact freely, the Flight Safety Officer must have uninhibited access to top management and all departments. The organisational structure shown in Figure 2.1 is one suggestion that provides direct access to the CEO and therefore eases communications throughout the organisation. The exact placement of the Flight Safety Officer function can vary from organisation to organisation, according to the culture, but the critical elements of access to top management, operations and maintenance should always be maintained.

Example Organisational Structure



Note: Safety & Quality functions may be combined under the same management function.

Formal Reporting ————————
Formal Communication ………………………

Figure 2.1

'2.4 SAFETY POLICIES, STANDARDS, & PROCEDURES

2.4.1 The management of safety is not only the responsibility of management. It is management that introduces the necessary procedures to ensure a positive cultural environment and safe practices.

2.4.2 Reviews of the safety performance of leading companies in safety-critical industries have shown that the best performers internationally use formal Safety Management Systems to produce significant and permanent improvements in safety. Reporting situations, events and practices that compromise safety should become a priority for all employees.

2.4.3 Each element will be measurable and its level of performance or efficiency will be measured at introduction and then at regular intervals. Specific and detailed targets will be set and agreed in each area to ensure continued incremental improvement of safety.

2.4.4 There are three prerequisites for successful safety management:

- A comprehensive corporate approach to safety
- An effective organisation to implement the safety programme
- Robust systems to provide safety assurance

These aspects are interdependent and a weakness in any one of them will undermine the integrity of the organisation's overall management of safety. If the organisation is effective in all three aspects, then it should also have a positive safety culture.

2.4.5 It is important to adhere to some important management disciplines:

- The manager responsible for developing the safety management system must ensure that all new safety management initiatives are well co-ordinated within a safety management development programme approved by top management.
- The development programme should be managed as a formal project, with regular reviews by top management.
- Each major change should be introduced only when the management team is satisfied that the change is compatible with existing procedures and management arrangements.

2.4.6 Standardised Operating Procedures (SOPs). SOPs are a major contribution to flight safety. Procedures are specifications for conducting actions; they specify a progression of steps to help operational personnel perform their tasks in a logical, efficient and, most important, error-resistant way. Procedures must be developed with consideration for the operational environment in which they will be used. Incompatibility of the procedures with the operational environment can lead to the informal adoption of unsafe operating practices by operational personnel. Feedback from operational situations, through observed practices or reports from operational personnel, is essential to guarantee that procedures and the operational environment remain compatible.

2.5 FLIGHT SAFETY OFFICER - JOB DESCRIPTION

2.5.1 Overall Purpose

The Flight Safety Officer is the individual responsible for the oversight of the Company's flight safety performance.

2.5.2 Dimension

2.5.2.1 The Flight Safety Officer must possess the highest degree of integrity.

The position demands a meticulous approach and the ability to cope with rapidly changing circumstances in varying situations entirely without supervision. The Flight Safety Officer acts independently of other parts of the Company

2.5.2.2 The job holder will be responsible for providing information and advice to the CEO on all matters relating to the safe operation of company aircraft. Tact and diplomacy are therefore prerequisite.

2.5.2.3 Assignments must be undertaken with little or no notice in irregular and unsocial hours.

2.5.3 Nature and Scope

2.5.3.1 The Flight Safety Officer must interact with line flight crew, maintenance engineers, cabin crew and other general managers and departmental heads throughout the company to encourage and achieve integration of all activities regardless of an individual's status and job discipline. The Flight Safety Officer should also foster positive relationships with regulatory authorities and outside agencies.

2.5.3.2 The main functional points of contact within the company on a day-to-day basis are:

- Chief Pilot
- Head of Operations
- Head of Security Services
- Head of Technical Services
- Ground Operations Management
- Flight Training and Standards Management
- Flight Crew Fleet Management
- Flight Crew Training Management
- Flight Operations Management
- Cabin Crew Management
- Engineering Quality Management
- Flight Operations Quality Management
- Maintenance/Technical Control Management
- Human Factors/CRM Management

2.5.4 Qualifications

2.5.4.1 There are few individuals who readily possess all the skills and qualities necessary to fulfil this post. The suggested minimum attributes and qualifications required are:

- A broad aviation/technical education
- A sound knowledge of commercial operations, in particular flight operations procedures and activities
- Experience as a flight crew member or engineer
- The ability for clear expression in writing
- Good presentation and interpersonal skills
- Computer literacy
- The ability to communicate at all levels, both inside and outside the Company
- Organisational ability
- To be capable of working alone (at times under pressure)
- Good analytical skills
- To exhibit leadership and an authoritative approach
- Be worthy of commanding respect among peers and management officials

2.5.5 Authority

2.5.5.1 On flight safety matters, the Flight Safety Officer has direct and immediate access to the CEO and all management and is authorised to conduct audits in connection with any aspect of the operation.

2.5.5.2 Where it is necessary to convene a company inquiry into an incident, the Flight Safety Officer has the authority to implement the proceedings on behalf of CEO in accordance with the terms of the company Operations Policy Manual.

2.5.6 Training

2.5.6.1 The person selected would be expected to become familiar with all aspects of the Company's organisation, it's activities and personnel. This will be achieved in part by in-house induction training but such knowledge is best acquired by self-education and research.

2.5.6.2 In-company training in basic computer skills such as word-processing, database management and spreadsheets should be undertaken. A Flight Safety Officer appointed from an engineering background should be given a condensed ground school and full-flight simulator course which teaches the basics of aircraft handling, navigation and the use of aeronautical charts.

2.5.6.3 External training at the very least should cover the management of a flight safety programme and basic accident investigation and crisis management.

2.5.6.4 Formal air safety training is available from a number of reputable sources internationally. Minimum training will consist of courses of instruction in basic air safety management and air accident investigation. A list of training establishments is shown in Appendix B.

2.5.7 <u>Flight Safety Officer - Terms of Reference</u>

2.5.7.1 To enable the Flight Safety Officer to implement and control the company flight safety programme the post-holder must have access to all departments at all levels. The primary responsibility is to provide information and advice on flight safety matters to the CEO.

2.5.7.2 The Flight Safety Officer is responsible to the CEO for:

- Maintaining the air safety occurrence reporting database
- Monitoring corrective actions and flight safety trends
- Co-ordinating the regulatory authority's Mandatory Occurrence Reporting scheme
- Liasing with the heads of all departments company-wide on flight safety matters
- Acting as Chairman of the Company Flight Safety Committee, arranging its meetings and keeping records of such meetings
- Disseminating flight safety-related information company-wide
- Maintaining an open liaison with manufacturers' customer flight safety departments, government regulatory bodies and other flight safety organisations world-wide
- Assisting with the investigation of accidents and conducting and co-ordinating investigations into incidents
- Carrying out safety audits and inspections
- Maintaining familiarity with all aspects of the Company's activities and its personnel
- Planning and controlling the Flight Safety budget
- Managing or have oversight of the FOQA Programme
- Publishing the periodic Company flight safety magazine
- Participation in corporate strategic planning

2.5.7.3 The basic fundamentals of salary, office space and furniture (including a dedicated telephone and fax machine) will most likely be allocated from a central administrative department. Additional funds will need to be obtained for:

- Personal computer (PC) hardware (including printer) to an approved industry standard
- PC software to support all flight safety functions
- Start-up of the electronic database, plus its maintenance
- Information Technology (IT=computer services) support for email and internet service providers
- Travel, accommodation and subsistence when undertaking assignments away from base
- Printing and stationery
- Subscriptions to industry publications and the purchase of regulatory authority documents and manuals
- Travel and subsistence for outstation visits (audit and liaison) and attendance at industry meetings and conferences
- Mobile telephone and pager

2.5.7.4 The following items of equipment and services are desirable, but not essential in a small operation:

- Home fax machine
- A supply of protective clothing for use in extreme climates
- Polaroid camera/Digital camera
- Memberships of professional organisations

2.5.7.5 As an operator expands its activities it will become increasingly difficult for the Flight Safety Officer to function as a single entity. A developing route network means an increase in fleet size and the introduction of new, perhaps different types of aircraft to the inventory. When this happens, the number of occurrences will increase in proportion to growth.

2.5.7.6 As an example, one European airline which started operations with a single wide-body aircraft operating long-haul transatlantic passenger services in 1984 had increased its fleet size to four by 1989. In that year 42 occurrences were recorded, only one of which was reportable to the regulatory authority and there were no major incidents. By 1999 the airline was operating 31 aircraft of four different types, its route network had expanded across the world and the incidence of occurrences had risen to about 1,500 per year.

2.5.7.7 In the above circumstances, a minimally staffed flight safety department cannot provide an adequate monitoring function so additional specialists will be needed. A method, which works well in practice, is to create the following secondary duty appointments:

- Fleet Flight Safety Officers (pilots or flight engineers qualified on type)
- Engineering Safety Officers (licensed ground engineers with broad experience)
- Cabin Safety Officers (senior cabin crew members who are experienced in cabin crew training and SEP [Safety Equipment and Procedures] development)

Their task is to assist with the monitoring of events peculiar to their own fleet or discipline and provide input during the investigation of occurrences.

2.6 RESPONSIBILITY & ACCOUNTABILITY

2.6.1 The primary responsibilities for safety are as follows:

- The CEO is collectively responsible for the safety and efficiency of Company operations and for authorising budgets accordingly. The annual Aviation Safety report produced by the Company will be authorised by the CEO.
- The Flight Safety Officer reports to the CEO and is responsible for proposing safety policy, monitoring its implementation and providing an independent overview of company activities in so far as they affect safety; maintenance, review and revision of the safety program; timely advice and assistance on safety matters to managers at all levels; and a reporting system for hazards
- The Quality Manager reports to the CEO and is responsible for proposing quality policy, monitoring its implementation and providing an independent overview of company activities in so far as they affect Quality.
- The Accountable Managers are responsible to the CEO for the efficient administration and professional management of all safety significant activities and tasks important to safety, which are within their defined areas of responsibility.

- The Safety Committees (Flight, Engineering and Ground Safety) review and co-ordinate the processes required to ensure the operations of the company and sub-contractors are as safe as reasonably practicable.

2.7 RECRUITING, RETENTION, DEVELOPMENT OF SAFETY PERSONNEL

2.7.1 The Flight Safety Officer must maintain a constant awareness of developments and various other company activities. Personalities change routinely therefore working relationships with new colleagues must be established. In a successful company new appointments will be created as departments expand; there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure.

2.7.2 Safety culture should start during the hiring process. If people with the right attitude are hired, their behaviour will be the cornerstone of a safety culture.

2.7.3 When recruiting a new employee or transferring an existing member of staff, their physical abilities and intellectual capacity should obviously match the requirements of the tasks they are to perform. Workers who are not suitable for the job cannot be expected to perform satisfactorily. Thorough selection procedures are therefore necessary.

2.7.4 The selection procedure, particularly the interview, is designed to assess the ability, attitudes and motivation of potential recruits. Where appropriate, references should be reviewed to substantiate previous experience. Relevant documentary evidence in the form of certificates or licences should be requested where appropriate.

The objectives of using such procedures are:

- To improve safety, quality, efficiency and employee morale
- To minimise the risk of placing employees in jobs to which they are not suited
- To reduce absenteeism and staff turnover

2.8 SAFETY TRAINING & AWARENESS

2.8.1 Training is of fundamental importance to effective job performance. Effective performance means compliance with the requirements of safety, profitability and quality. To meet this training need, it is necessary to establish a programme which ensures:

- A systematic analysis, to identify the training needs of each occupation
- The establishment of training schemes to meet the identified needs
- The training is assessed and is effective, in that each training session has been understood and the training programme is relevant

It involves the review of all occupations, analysis and observation of critical activities, accident and incident analysis and statutory requirements. The objective of all training is to equip employees with the skills and knowledge to carry out their duties safely and effectively.

All appropriate training methods should be used, but there will be no substitute for practical on-the-job instruction in some occupations. Whatever training techniques are adopted, it is important that the effectiveness of the training is assessed and that training records are maintained. Periodic reviews of the training programme are required to ensure that it remains relevant and effective.

2.8.2 Management Safety Awareness and Training

2.8.2.1 For the successful operation of any management system, it is essential that the management team understand the principles on which the system is based. Effective training of management ensures this objective. Training should equip all those having supervisory responsibility with the necessary skills to implement and maintain the safety programme.

2.8.2.2 This element details the training of managers and supervisors in the following areas:

- Initial training, soon after appointment to a supervisory position, to acquaint new managers and supervisors with the principles of the safety management system, their responsibilities and accountability for safety and statutory requirements
- Detailed training in the safety management system including the background and rationale behind each element
- Skills training in relevant areas such as communications, safety auditing and conducting group meetings
- Regular update and refresher training

2.8.2.3 Corporate training courses ensure that managers and supervisors are familiar with the principles of the Safety Management System and their responsibilities and accountabilities for safety. On-site training ensures that all staff are acquainted with the relevant information appropriate to their function.

2.8.2.4 It is also important that training is provided at an early stage for the safety custodian. The custodian needs to be aware of the detail of the safety management system and also proven techniques for implementing the elements. As the focal point for the system, the safety custodian should be thoroughly conversant with the programme and safety management principles.

2.8.3 Fundamentals of Training Implementation

2.8.3.1 The greatest benefits are achieved by adhering to the following practices:

- Assess the status of the organisation before implementation. It is important to know how widely concepts are understood and practised before designing specific training. Surveys, observations at work, and analysis of incident/accident reports can provide essential guidance for program designers.
- Get commitment from all managers, starting with senior managers. Resource management programs are received much more positively by operations personnel when senior managers, flight operations managers, and flight standards officers conspicuously support the basic concepts and provide the necessary resources for training. Training manuals should embrace concepts by providing employees with the necessary policy and procedures guidance.

- Customise the training to reflect the nature and needs of the organisation. Using knowledge of the state of the organisation, priorities should be established for topics to be covered including special issues such as the effects of mergers or the introduction of advanced technology aircraft.
- Define the scope of the programme. Institute special training for key personnel including developers/facilitators and supervisors. It is highly beneficial to provide training for these groups before beginning training for others. The training may later be expanded to include pilots, flight attendants, maintenance personnel, and other company resource groups as appropriate. It is also helpful to develop a long-term strategy for program implementation.
- Communicate the nature and scope of the programme before start-up. Training departments should provide employees with a preview of what the training will involve together with plans for initial and continuing training. These steps can prevent misunderstanding about the focus of the training or any aspect of its implementation.

2.8.3.2 In conclusion, effective resource management begins in initial training; it is strengthened by recurrent practice and feedback; and it is sustained by continuing reinforcement that is part of the corporate culture and embedded in every element of an employee's training.

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SECTION 3 - SAFETY PROGRAM ACTIVITIES

3.1 INTRODUCTION

3.1.1 The elements of the Safety Management System outlined in this document are not exhaustive, but give an introduction to one approach to safety management. It is important to understand that the information contained in this section is designed to explain the principles and does not constitute an action plan.

3.1.2 These elements are the individual building blocks of the system, but they should only be introduced in a planned and project managed process and their implementation should be phased to ensure the success of each stage. Aspects of some of the elements may already be in place, but may need to be modified in order to be compliant with the requirements of the Company's Safety Management System.

3.2 OBJECTIVES & DESCRIPTIONS

3.2.1 Maintaining Familiarity with the Company's Activities

3.2.1.1 The Flight Safety Officer must maintain a constant awareness of developments. Personnel change routinely, therefore, working relationships with new colleagues must be established. In a successful Company, new appointments will be created as departments expand; there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure. As well, in times of economic constraint, positions may be eliminated and duties increased.

3.2.1.2 The procedures set out in this handbook are designed to accommodate such changes, but in order to obtain the best benefits a periodic review of the flight safety programme in relation to the Company's development is essential.

3.3 COMPANY FLIGHT SAFETY COMMITTEE

3.3.1 The formation of a Flight Safety Committee (sometimes called a Flight Safety Review Board) provides a method of obtaining agreement for action on specific problems. Its task is to:

- Provide a focus for all matters relating to the safe operation of Company aircraft
- Report to the Chief Executive on the performance of the Company in relation to its flight safety standards

3.3.2 The committee should not be granted the authority to direct individual departments or agencies. Such authority interferes with the chain of command and is counter-productive. Where the need for action is identified during matters arising at meetings, a recommendation from the committee is usually sufficient to obtain the desired result.

3.3.3 Membership

3.3.3.1 Membership of the committee should be made up of management representatives from key Flight Operations, Engineering, Flight, and Cabin Crew Training departments. It is at this departmental level where most problems surface.

3.3.3.2 Numbers should be kept to a minimum. The following list is not exhaustive and membership should typically consist of:

- Flight Safety Officer
- Flight Operations Director
- Chief Pilot
- Flight Training and Standards Management
- Fleet Management (or Fleet Training Captains)
- Quality Management (Engineering and Flight Operations)
- Line Maintenance Management
- Flight Operations Management
- Ground Operations Management
- Cabin Crew Management

3.3.4 Managing the Committee

3.3.4.1 In a small, developing organisation, the Flight Safety Officer may have the dual role of Chairman and Secretary. Chairmanship (i.e. control of the committee) can be vested in any other member, but the independence of office grants the Flight Safety Officer an overall view of the operation and is therefore the least likely member to become focussed on an isolated issue. As the organisation expands and the size of the committee increases, the Flight Safety Officer may relinquish one or both duties to another member of the committee.

3.3.4.2 Minutes must be recorded for circulation to the Chief Executive, Committee members and other staff as appropriate. The minutes should contain a summary of incidents which have occurred since the last meeting together with brief details of corrective action and preventive measures implemented.

3.3.4.3 Secretarial duties also include arranging meetings, booking the venue, and setting out and circulating the agenda.

3.3.4.4 Safety Committees are an important tool of safety management and are invaluable in fostering a positive safety culture. These committees will help to identify problem areas and implement solutions. The details of safety improvements derived from these meetings should be widely communicated throughout the organisation.

3.3.4.5 The importance of regularly held, formal safety meetings cannot be overstated. The safety management system can only continue to be relevant to the company if the decisions made at these meetings are acted upon and supported by senior management.

3.3.4.6 The active representation of the CEO and departmental heads is vital if safety committees are to be effective. The people who have the capacity to make and authorise decisions should be in attendance. Without the involvement of these decision-makers, the meetings will just be "talking shops." Departmental heads should also hold regular meetings with their staff to allow safety concerns and ideas to be discussed.

3.3.4.7 The importance given by the CEO and all levels of management to resolving safety issues at these meetings will demonstrate the company's commitment to safety.

3.3.4.8 The structure and number of committee's will depend on the size of the organisation and it might be sufficient for a small operation to manage with one committee covering all areas. Larger organisations may require a formal structure of safety review boards and safety committees to manage their requirements. A method should also be established for all employees to have a written or verbal input into the appropriate meetings.

3.3.4.9 The purpose of these committees and review boards is to co-ordinate the required processes to ensure that the operations of the company and its sub-contractors are as safe as reasonably practicable.

3.3.4.10 A quarterly meeting is a reasonable and practical timetable. This can be reviewed as the committee's activities (and those of the company) develop. An extraordinary meeting may be called at any other time the Chairman considers it necessary (following a major incident, for example).

3.3.4.11 Meetings should be arranged on a regular basis and the schedule published well in advance, ideally a year. The circulation list should include members' secretaries and Crew Scheduling for flight crew members. Scheduled meetings should be re-notified two weeks before the appointed day.

3.3.5 Agenda

3.3.5.1 The agenda should be prepared early and distributed with the two-week notification. Solicit members for items they wish to be included for discussion, and make it known that only published agenda items will be discussed.

3.3.5.2 An example format that allows the Chairman to exercise proper control is:

- Review the minutes of the previous meeting
- Review of events (incl. incidents/accidents)
- MORs since the last meeting
- New business

3.3.5.3 Have spare copies of the agenda and any relevant documents to hand at the start of the meeting.

3.3.6 Summary

- Notify meetings and distribute the agenda well in advance
- Place a time limit on the proceedings - start and finish on time
- Discuss only agenda items - summarise frequently
- When collective agreement on a particular issue is reached, write it down for publication in the minutes
- Keep the meeting flowing. Its purpose is to present reasoned, collective judgement

- Do not let arguments develop or allow members to return to items already closed
- Make sure that the minutes are an accurate record of the committee's conclusions
- Always let the committee know when action items are completed
- Ban mobile telephones from the meeting room!

3.4 HAZARD REPORTING

3.4.1 Staff must be able to report hazards or safety concerns as they become aware of them. The ongoing hazard reporting system should be non-punitive, confidential, simple, direct and convenient. Once hazards are reported they must be acknowledged and investigated. Recommendations and actions must also follow to address the safety issues.

3.4.2 There are many such systems in use. The reporting form for the Bureau of Air Safety Investigation (BASI), Australia Confidential Aviation Incident Reporting (CAIR) system could be adapted for this purpose (example reporting forms are provided in Appendix A). Ensuring a confidential and non–punitive system will encourage reporting of hazards. It should also allow for the reporting of hazards associated with the activities of any contracting agency where there may be a safety impact. The system should include a formal hazard tracking and risk resolution process. Hazards should be defined in a formal report. The report should be tracked until the hazard is eliminated or controlled to an acceptable risk. The controls should also be defined and should be verified as formally implemented.

3.4.3 <u>What hazards should staff report?</u>

3.4.3.1 All staff should know what hazards they are required to report. Any event or situation with the potential to result in significant degradation of safety and can cause damage and/or injury should be reported.

3.4.4 <u>How will staff report hazards?</u>

3.4.4.1 The Company might like to use existing paperwork, such as the pilot's report, for flying operations. It is easy to provide a dedicated reporting form for other functional areas. Make sure that reports are acted upon in a timely manner by the person responsible for your safety program.

3.4.4.2 In a small organisation it may be difficult to guarantee the confidentiality of safety reports, so it is vital that a trusting environment is fostered by management. Make the reporting system simple and easy to use. Suggested reports:

- Pilot's report
- Hazard/safety report form

3.4.4.3 The reporting system should maintain confidentiality between the person reporting the hazard and the Flight Safety Officer. Any safety information distributed widely as a result of a hazard report must be de-identified.

3.4.4.4 The system should include procedures such as:

- All safety reports go to the Flight Safety Officer
- The Flight Safety Officer is responsible for investigation of the report and for maintenance of the confidentiality of reports
- While maintaining confidentiality, the Flight Safety Officer must be able to follow-up on a report to clarify the details and the nature of the problem
- Anyone submitting a safety report must receive acknowledgement and feedback
- After investigation, the de-identified safety report and recommendations should be made widely available for the benefit of all staff

3.4.5 <u>To whom will the reports go, and who will investigate them?</u>

3.4.5.1 Management should be included in the risk management process. Decisions concerning risk acceptability should be made by management and they should be kept informed of all high risk considerations. Hazards that were not adequately dispositioned should be communicated to management for resolution.

3.4.5.2 Reports should be distributed to, as a minimum, the following:

- The person responsible for managing the safety programme
- The flight safety committee (if applicable)
- The originator of the report

3.4.6 <u>Human Element in Hazard Identification and Reporting</u>

3.4.6.1 The human is the most important aspect in the identification, reporting, and controlling hazards. Most accidents are the result of an inappropriate human action, i.e. human error, less then adequate design, less then adequate procedure, loss of situational awareness, intentional action, less then adequate ergonomic, or human factor consideration. Human contributors account for 80 to 90 % of accidents. To a system safety professional mostly all accidents are the result of human error.

3.4.6.2 At inception of a system, a hazard analysis should be conducted in order to identify contributory hazards. However, if these hazards were not eliminated, then administrative hazard controls must be applied, i.e. safe operating procedures, inspections, maintenance, and training.

3.4.6.3 The behaviour-based approach to safety focuses on the human part of the equation. The approach is proactive and preventive in nature. It is a process of identifying contributory hazards and gathering and analysing data to improve safety performance. The goal is to establish a continued level of awareness, leading to an improved safety culture.

3.4.6.4 To successfully apply the behaviour-based approach everyone in the organisation should participate. In summary, the people in the organisation are trained in hazard identification. The concept of a hazard, (i.e. an unsafe act or unsafe condition that could lead to an accident), is understood. Participants develop lists of hazards in their particular environment and then they conduct surveys to identify unsafe acts or unsafe conditions. Hazards are then tracked to resolution. The process should be conducted positively rather than negatively. One does not seek to lay blame of assign causes. The participants are to be positively rewarded for efforts, thereby improving the safety culture.

3.4.7 Monitoring and Tracking (Feedback)

3.4.7.1 Maintaining the Air Safety Occurrence Database

3.4.7.1.1 Data for trend analysis is gathered from Air Safety Reports (ASRs) submitted by flight crew and ground crew. The purpose of these reports is to enable effective investigation and follow-up of occurrences to be made and to provide a source of information for all departments. The objective of disseminating reported information is to enable safety weaknesses to be quickly identified.

3.4.7.1.2 Paper records can be maintained in a simple filing system, but such a system will suffice only for the smallest of operations. Storage, recording, recall and retrieval is a cumbersome task. ASRs should therefore preferably be stored in an electronic database. This method ensures that the Flight Safety Officer can alert departments to incidents as they occur, and the status of any investigation together with required follow-up action to prevent recurrence can be monitored and audited on demand.

3.4.7.1.3 There are a number of specialised air safety electronic databases available (a list of vendors is shown in Appendix B). The functional properties and attributes of individual systems vary, and each should be considered before deciding on the most suitable system for the operator's needs. Once information from the original ASR has been entered into an electronic database, recall and retrieval of any number of single or multiple events over any period of time is almost instant. Occurrences can be recalled by aircraft type, registration, category of occurrence (i.e. operational, technical, environmental, etc.) by specific date or time span.

Note: IATA's Safety Committee (SAC) operates a safety information exchange scheme (SIE) and compiles statistics using an electronic database. Stored records are de-identified and subscribers to the scheme have free access. Very small airlines (i.e. those having only one or two aircraft) can benefit in that they can measure their progress against the rest of the world and quickly identify global trends.

3.4.7.1.4 The database is networked to key departments within Flight Operations and Engineering. It is the responsibility of individual department heads and their specialist staffs to access records regularly in order to identify the type and degree of action required to achieve the satisfactory closure of a particular occurrence. It is the Flight Safety Officer's responsibility to ensure that calls for action on a particular event are acknowledged and addressed by the department concerned within a specified timescale. The database should not be used simply as an electronic filing cabinet.

3.4.7.1.5 Once the required action is judged to be complete and measures have been implemented to prevent recurrence, a final report must then be produced from consolidated database entries. The event can then be recommended for closure.

3.5 *IMMUNITY-BASED REPORTING*

3.5.1 It is fundamental to the purpose of a reporting scheme that it is non-punitive, and the substance of reports should be disseminated in the interests of flight safety only.

3.5.2 The evidence from numerous aviation accidents and incidents has shown that the lack of management control and human factors are detrimental to the safe operation of aircraft. The management of safety is not just the responsibility of management, but it is management who has to introduce the necessary procedures to ensure a positive cultural environment and safe practices.

3.5.3 Reviews of the safety performance of leading companies in safety-critical industries have shown that the best performers internationally use formal Safety Management Systems to produce significant and permanent improvements in safety. It is also important to develop a safety culture that encourages openness and trust between Management and the work force. For example, all employees should feel able to report incidents and events without the fear of unwarranted retribution. Reporting situations, events and practices that compromise safety should become a priority for all employees.

3.5.4 The aim of this guide is to introduce the elements of a safety management system. Each element will be measurable and its level of performance or efficiency will be measured at introduction and then at regular intervals. Specific and detailed targets will be set and agreed in each area to ensure continued incremental improvement of safety.

3.5.5 <u>Confidential Reporting Programmes</u>

3.5.5.1 It has been estimated that for each major accident (involving fatalities), there are as many as 360 incidents that, properly investigated, might have identified an underlying problem in time to prevent the accident. In the past two decades, there has been much favourable experience with non-punitive incident and hazard reporting programs. Many countries have such systems, including the Aviation Safety Reporting System (ASRS) in the United States and the Confidential Human Factors Incident Reporting Program (CHIRP) in the United Kingdom. In addition to the early identification and correction of operational risks, such programs provide much valuable information for use in safety awareness and training programs.

3.5.5.2 These aspects are interdependent and a weakness in any one of them will undermine the integrity of the organisation's overall management of safety. If the organisation is effective in all aspects, then it should also have a positive safety culture.

3.5.5.3 Reports should preferably be recorded in an electronic database such as BASIS (British Airways Safety Information System). This method ensures that departments are made aware of incidents as they occur, and the status of any investigation together with required follow-up action to prevent recurrence can be monitored.

3.5.6 <u>Occurrence Reporting Schemes</u>

3.5.6.1 Some States legislate a Mandatory Occurrence Reporting (MOR) scheme. If such a scheme does not exist it is beneficial for the company to initiate its own. Without prejudice to the proper discharge of its responsibility, neither the regulatory authority nor the company should disclose the name of any person submitting a report, or that of a person to whom it relates unless required to do so by law, or unless the person concerned authorises a disclosure. Should any flight safety follow-up action be necessary, the regulatory authority will take all reasonable steps to avoid disclosing the identity of the reporter or of individuals involved in the occurrence.

3.5.6.2 Occurrences Which Should be Reported to the Flight Safety Officer:

The following list is neither exhaustive nor shown in order of importance. Example reporting forms are provided in Appendix A. **If there is any doubt, a report should be filed for any of the following**:

- **System defect** occurs which adversely affects the handling characteristics of the aircraft and renders it unfit to fly
- Warning of **fire** or **smoke**
- An **emergency** is declared
- **Safety equipment** or **procedures** are defective or inadequate
- Deficiencies exist in **operating procedures**, **manuals** or **navigational charts**
- **Incorrect loading** of fuel, cargo or dangerous goods
- **Operating standards** are degraded
- **Any engine has to be shut down in flight**
- **Ground damage** occurs
- A **rejected take-off** is executed after take-off power is established
- A **runway** or **taxiway excursion** occurs
- Significant **handling difficulties** are experienced
- A **navigation error** involving a significant deviation from track
- An **altitude excursion** of more than 500 feet occurs
- An **exceedance of the limiting parameters** for the aircraft configuration or when a significant **unintentional speed change** occurs
- **Communications fail** or are impaired
- A **GPWS warning** occurs
- A **stall warning** occurs
- A **heavy landing check** is required
- Serious **loss of braking**
- Aircraft is **evacuated**
- Aircraft lands with **reserve fuel or less** remaining
- An **AIRPROX (Airmiss) or TCAS event, ATC incident** or **wake turbulence** event occurs
- Significant **turbulence, windshear** or other **severe weather** is encountered
- Crew or passengers become **seriously ill**, are **injured** or become **incapacitated**
- Difficulty in controlling **violent, armed** or **intoxicated passengers** or when restraint is necessary
- **Toilet smoke detectors** are activated
- Any part of the aircraft or its equipment is **sabotaged** or **vandalised**
- **Security procedures** are breached
- **Bird strike** or **Foreign Object Damage (FOD)**
- **Unstabilised approach under 500 feet**
- **Or any other event considered to have serious safety implications**

3.5.6.3 The objective and systematic observation of activities being performed can yield much useful information for the safety management system and help to reduce losses. The aim is to reveal problems and shortcomings, which could lead to accidents. Typically such shortcomings can be inadequate equipment or procedures, lack of effective training, or the use of inappropriate materials. The outcome should be action to reduce and control risks.

3.5.6.4 Follow-up and Closure of Reports

3.5.6.4.1 Some reports can be closed on receipt. If follow-up is required, action will have been assigned to the appropriate department(s). The Flight Safety Officer will review responses and, if satisfactory, recommend closure of the incident at the next Flight Safety Committee meeting. If responses are unsatisfactory and do not address the problem, the incident must remain open for continuing review and action as required.

3.5.6.4.2 If a State Mandatory Occurrence Reporting (MOR) scheme is in effect, recommendation for the closure of a report must be agreed with the regulatory authority. The authority and the reporter must be informed of action taken once the incident is closed.

3.6 COMPLIANCE & VERIFICATION (QUALITY SYSTEM)

3.6.1 Complying with policies and safety regulations can require considerable time commitments and resources. Planning ahead to complete required compliance issues can save the company money by improving your employee scheduling and help to avoid potential penalties resulting from non-compliance. Compliance issues can require a wide variety of safety activities on the part of the operator. The primary compliance items generally involve training, walk-through functions, and monitoring existing programmes.

3.6.2 When a Quality System is in operation, compliance and verification of policies and state regulations is accomplished through Quality Audits.

3.6.3 When the Safety Management System is first implemented, a system safety assessment will have been carried out to evaluate the risks and introduce the necessary controls. As the Organisation develops, there will inevitably be changes to equipment, practices, routes, contracted agencies, regulations, etc. In order for the safety management system to remain effective it must be able to identify the impact of these changes. Monitoring will ensure that the safety management system is updated to reflect the changes in organisational circumstances (and is reviewed constantly).

3.6.4 Monitoring the safety management system is the way in which it is constantly reviewed and refined to reflect the company's changing arrangements. Statistical recording of all monitoring should be undertaken and the results passed to the safety manager

3.7 SAFETY TRENDS ANALYSIS

3.7.1 **One event can be considered to be an isolated incident; two similar events may mean the start of a trend. This is a safe rule to follow**. If an event recurs after preventive measures are in place the cause must be determined to ascertain whether further corrective action is necessary or whether the steps in a particular operating procedure or maintenance schedule have been ignored.

3.7.2 An electronic database is capable of providing an automatic trend analysis by event and aircraft system type, with the results being displayed in either graphic or text format.

3.7.3 Flight safety-related incidents are best recorded and tracked using a PC-driven electronic database. Most programmes are modular, MS Windows-based applications designed to run on Windows versions 3.1, '95, '98 or NT. The number of features available will depend on the type and standard of system selected.

3.7.4 Basic features enable the user to:

- Log flight safety events under various categories
- Link events to related documents (e.g. reports and photographs)
- Monitor trends
- Compile analyses and charts
- Check historical records
- Data-share with other organisations
- Monitor event investigations
- Apply risk factors
- Flag overdue action responses

3.7.5 When notes relating to an event have been entered, the programme will automatically date- and time-stamp the record and also log the name of the person who input the information. The system administrator can limit or extend an individual user's viewing and amendment capability by controlling rights of access (e.g. view-only/add notes/edit notes/delete entries/access crew names, etc.).

3.7.6 Additional modules provide enhancements such as:

- Flight parameter exceedances
- Flight instrument replay
- Flight path profile display
- Cost analysis

Note: For a list of suppliers, please refer to Appendix B.

3.8 FOQA COLLECTION/ANALYSIS

3.8.1 Flight Operations Quality Assurance (FOQA) is the routine downloading and systematic analysis of DFDR data whose threshold limits are set (with a suitably built-in safety margin) from aircraft systems parameters. The European Community has enjoyed the benefits from this process of analysis for over 30 years. The US Community is currently implementing FOQA via a Demonstration Project sponsored by the FAA. Airline participation is increasing and positive results have been realised.

3.8.2 Modern glass-cockpit and fly-by-wire aircraft are delivered equipped with the necessary data buses from which information can be downloaded virtually on demand to a quick-access flight recorder for subsequent analysis. Older aircraft can be retrofitted to suit the needs of the operator.

3.8.3 A FOQA programme should be managed by a dedicated staff within the safety or operations departments. It should have a high degree of specialisation and logistical support. It must be recognised as a programme which is founded on a bond of trust between the operator, its crews and the regulatory authority. The programme must actively demonstrate a non-punitive policy. The main objective of a FOQA programme is to improve safety by identifying trends, not individual acts.

3.8.4 The purpose of a FOQA programme is to detect latent patterns of behaviour amongst flight crews, weaknesses in the ATC system and anomalies in aircraft performance which portend potential aircraft accidents.

3.8.5 <u>Benefits of a FOQA Programme</u>

3.8.5.1 A successful FOQA programme encourages adherence to Standard Operating Procedures, deters non-standard behaviour and so enhances flight safety. It will detect adverse trends in any part of the flight regime and so facilitates the investigation of events other than those which have had serious consequences. Examples include:

- Unstabilised and rushed approaches
- Exceedance of flap limit speeds
- Excessive bank angles after take-off
- Engine over-temperature events
- Exceedance of recommended speed thresholds (Vspeeds)
- Ground Proximity Warning System (GPWS/EGPWS) alerts
- Onset of stall conditions
- Excessive rates of rotation
- Glidepath excursions
- Vertical acceleration

3.8.5.2 For crewmembers, a properly developed and executed FOQA programme (i.e. one that is non-punitive, confidential and anonymous) is non-disciplinary and does not jeopardise the crewmember's career.

3.8.6 <u>FOQA in Practice</u>

3.8.6.1 After the data is analysed and verified by the FOQA staff, the events are grouped by aircraft fleet and examined in detail by fleet representatives. They use their knowledge of the aircraft and its operation to make an assessment. If necessary, a pilot's association representative may be requested to speak informally with the flight crew concerned to find out more about the circumstances.

3.8.6.2 The pilot's association representative may either just take note of the crew's comments or highlight any deviation from SOP. If deficiencies in pilot handling technique are evident then the informal approach, entirely remote from management involvement, usually results in the pilot self-correcting any deficiencies. If any re-training is found to be necessary, this is carried out discreetly within the operator. An agreed upon representative should be the contact with crew members in order to clarify the circumstances, obtain feedback, and give advice and recommendation for training or other appropriate action. It is suggested that a formal written agreement between the organisation and the industrial/trade organisations representing the employees be implemented concerning the FOQA programme, as well as any voluntary reporting systems.

3.8.6.3 Where the development of an undesirable trend becomes evident (i.e. within a fleet or at a particular phase of flight or airport location), then the fleet's training management can implement measures to reverse the trend through modification of training exercises and/or operating procedures.

3.8.6.4 As a quality control tool, flight data monitoring through a FOQA programme will highlight deviations from SOP, which are of interest even if they do not have direct safety consequences. This is particularly useful in confirming the effectiveness of training methods used either in recurrent training or when crews are undergoing type conversion training.

3.8.7 Implementing a FOQA Programme

3.8.7.1 Bearing in mind the high degree of specialisation and extensive resources required it would take up to 12 months for a FOQA programme to reach the operational phase and a further 12 months before safety and cost benefits can begin to be accurately assessed.

3.8.7.2 Planning and preparation should be undertaken in the following sequence:

- Establish a steering committee. Involve the pilot's association from the start
- Define the objective
- Identify participants and beneficiaries
- Select the programme
- Select specialist personnel
- Define event parameters
- Negotiate pilot and union agreement
- Launch FOQA

3.8.7.3 Implementation:

- Establish and check security procedures
- Install equipment
- Train personnel
- Begin to analyse and validate data

3.8.8 US FAA FOQA Programme

3.8.8.1 The FAA has sponsored a FOQA Demonstration study in co-operation with industry in order to permit both government and industry to develop hands-on experience with FOQA technology in a US environment, document the cost-benefits of voluntary implementation, and initiate the development of organisational strategies for FOQA information management and use. The FOQA Demonstration Study has been conducted with major operators in the US. Analysis of the flight data information, which is deidentified at the time of collection, has provided substantial documentation of the benefits of FOQA. The Study results are very similar to the results of foreign air carriers, many of whom have long experience in the use of this technology.

3.8.8.2 Based on the results of this study, the FAA has concluded that FOQA can provide a source of objective information on which to identify needed improvements in flight crew performance, air carrier training programmes, operating procedures, air traffic control procedures, airport maintenance and design, and aircraft operations and design. The acquisition and use of such information clearly enhances safety.

3.8.8.3 For further information contact:

Federal Aviation Administration
Air Transport Division
Flight Standards Service
PO Box 20027
Washington, DC 20591
USA

Web: www.faa.gov/avr/afshome.htm

3.8.9 FOQA Summary

3.8.9.1 A flight safety department is generally seen by accountants as one that does not contribute to the profitability of an operator; it only appears to spend money. **Although there may be monetary benefits to be gained by the introduction of a FOQA programme, its main contribution is that overall flight safety is enhanced.**

Note: Suppliers of QARs to support FOQA and Performance Monitoring Programmes can be found in Appendix B.

3.8.10 Flight Data Recorder (FDR) Collection/Analysis

3.8.10.1 One of the most powerful tools available to a company, striving for improvements in the safe operation of its aircraft, is the use of FDR analysis. Unfortunately it is often viewed as one of the most expensive in terms of the initial outlay, software agreements and personnel requirements. In reality it has the potential to save the Company money by reducing the risk of a major accident, improving operating standards, identifying external factors affecting the operation and improving engineering monitoring programmes.

3.8.10.2 FDR analysis allows the monitoring of various aspects of the flight profile such as the adherence to the prescribed take-off, initial climb, descent, approach and landing phases. By selecting specific aspects it is also possible to concentrate on them in either a proactive way prior to changes in the operation or retrospectively. The introduction of a new fleet or new routes for example will inevitably expose the Company to new hazards and influence existing ones, potentially increasing the risk of a major incident.

3.8.10.3 Using the analysis of the FDR after an incident is becoming quite common, but the ability to compare a specific flight with the fleet profile gives the ability to analyse the systemic aspects of the incident. It may be that the parameters of the incident vary only slightly from numerous other flights, indicating the requirement for a change in operating technique or training. For example, it would be possible to determine whether a tailscrape on landing was an isolated incident or symptomatic of mishandling during the approach or over-flaring on touchdown

3.8.10.4 Engine monitoring programmes are often computer based, but rely on the manually recorded subjective data being manually input. A time consuming and labour intensive process that limits its potential to be accurate and proactive. For example an engine may fail before a trend has been identified. Using FDR data, accurate analysis is possible within a short time scale, increasing the potential for preventative action. It also becomes possible to monitor other aspects of the airframe and components.

3.8.10.5 A properly constituted FDR programme has the greatest potential for improving the safety of operating techniques and increasing the company's knowledge of its aircraft performance.

3.8.10.6 It should be emphasised that the standardisation of data collection and reporting programs across the aviation industry is essential to enable information sharing between all operators. For example, Transport Canada has sponsored the development of a Flight Recorder Configuration Standard (FRCS) that defines the content and format for electronic files that describe the flight data stored on a flight data recorder system. Further efforts are required to accomplish this goal.

3.9 DISSEMINATION OF FLIGHT SAFETY INFORMATION

3.9.1 The Flight Safety Officer must have sound knowledge and understanding of the types and sources of information available, and must therefore have ready access to libraries and files. Operations and Engineering procedures are set out in individual aircraft type Operations Manuals (OM), Aeroplane Flight Manuals (AFM), Flight Crew Operations Manuals (FCOM) and Maintenance Manuals (MM). Any supplementary flight safety-related information that is of an operational or engineering nature is promulgated by:

- Notices issued by the aircraft or equipment manufacturer
- Company notices

3.9.2 Effective communication is vital to promoting a positive safety culture. The crucial point is not so much the apparent adequacy of safety plans but the perceptions and beliefs that people hold about them. A company's safety policies and procedures may appear well considered but the reality among the workforce may be sullen scepticism and false perceptions of risk.

3.9.3 Research clearly shows that openness of communication and the involvement of Management and workers characterise companies with positive safety culture while poor safety culture is associated with rumour-driven communications, step-change reorganisation, lack of trust, rule book mentality and "sharp-end" blame culture.

3.9.4 Critical safety topics should be selected for promotional campaigns based on their potential to control and reduce losses due to accidents and incidents. Selection should therefore be based on the experience of past accidents or near misses, matters identified by hazard analysis and observations from routine safety audits. Employees should also be encouraged to submit suggestions for promotional campaigns.

3.9.5 Recognition of good safety performance can have promotional value provided that it is based on safety performance measured against high safety standards. Awards for good accident records have unfortunately been found to encourage the concealment of accidents and are not recommended.

3.9.6 Communication is a major part of any management activity. To communicate effectively, a company must first assess the methods available and then determine those that are the most appropriate. All methods of communication must allow upwards as well as downwards transfer of information and must encourage feedback from all users of the safety management system.

3.9.7 The Flight Safety Officer must co-ordinate the dissemination of flight safety information within and outside the company. The precise method adopted and the channels used will depend on the degree and type of administrative support available.

3.9.8 <u>Other Flight Safety Information</u>

3.9.8.1 The regulatory authority may require the operator to disseminate other flight safety-related information as part of its Accident Prevention and Flight Safety Programme. JAR-OPS (1.037), for example, requires operators to *" Establish programmes . . . for the evaluation of relevant information relating to accidents and incidents and the promulgation of related information."* Whether compulsory or voluntary, such a programme is essential in maintaining a flight safety awareness throughout the company. There are many sources from which to draw on.

3.9.8.2 All personnel should be responsible for keeping themselves appraised of flight safety matters and for studying promptly any material distributed to them. The company Operations Policy Manual should contain an instruction to this effect. The Flight Safety Officer should also encourage the submission of flight safety information from any source for evaluation and possible distribution.

3.9.8.3 The method of disseminating general flight safety information in-company must be decided by the Flight Safety Officer. It is best accomplished by the publication of regular flight safety newsletters, magazine-type reviews and the use of bulletin boards. The former can be distributed either in paper form or electronically using an Intranet facility if it is available. Whatever the chosen methods, information relative to each discipline must be circulated to every member of flight crew, cabin crew, maintenance staff, and ground/flight operations.

3.9.8.4 Industry Occurrence Reports: These can sometimes be obtained from the regulatory authority. The UK CAA, for example, through its Safety Data Analysis Unit, publishes a monthly list of reportable occurrences involving aircraft and equipment failures, malfunctions and defects during UK public transport operations. Occurrences are listed under Fixed-Wing, Rotary-Wing, and ATC categories. There is also a monthly Digest of Occurrences, which amplifies selected incidents and essays various flight safety topics of interest. Occurrence lists are provided free to the UK civil aviation industry and supporting organisations. They are available on subscription to any other airline or organisation world-wide that has a legitimate interest in flight safety. De-identified reports submitted through the CHIRP (UK) and ASRS (US) voluntary reporting schemes are also available on request.

3.9.8.5 Industry Accident Reports and Bulletins: Full accident reports are published only when Government investigation is complete. The following are examples of organisations that make reports available either free, by subscription or on payment of a fee:

- Australian Bureau of Air Safety Investigation
- Canadian Transportation Safety Board
- French Bureau Enquetes-Accidents
- UK Air Accidents Investigation Branch
- United States National Transportation Safety Board
- Brazilian Centro de Investigagco e Prevengco de Acidentes Aeronauticos

3.9.8.6 In-Company Flight Safety Reviews and Newsletters: These should ideally be published quarterly and contain a varied selection of flight safety topics presented in coffee-table magazine. A proven successful layout is to lead with an editorial (preferably composed by a senior management personality) and follow with one major article which analyses a major accident (whether historic or recent, there are lessons to be learned) and then include articles on ATC, maintenance, flight crew training, aviation medicine, winter operations, etc. A summary of Company occurrences over the previous quarter should be included. Small ingredients of humour in the form of anecdotes and cartoons will sustain the reader's interest. Production of copy for printing is a continuous activity and entirely the province of the Flight Safety Officer; its success and appeal is limited only by the editor's imagination and resourcefulness as well as budgetary constraints. The main disadvantage of in-house magazines is that they are labour-intensive to research and compile and can be costly to produce. However, an informative, balanced, well-written publication fosters good relations with flight crews and lets the whole organisation know who the Flight Safety Officer is; it also demonstrates commitment to improving flight safety awareness.

3.9.9 Company NOTAMS

3.9.9.1 A system of notifying crews quickly of critical flight safety-related events should be established. Company NOTAMS can be originated from within the Flight Planning Department and promulgated via telex to crew report centres world-wide. These 'must-read' notices enable all crews reporting for duty throughout the network to evaluate information immediately and act on it without delay. The Flight Safety Officer can make effective use of this system.

3.9.9.2 The following is an example of a selection of topics covered by Company NOTAMS:

QD
.LHRODXY 291300 31 FEB 99
XYZ AIRLINES - COMPANY NOTAMS
PREPARED BY FLIGHT PLANNING DEPARTMENT - PHONE 11111-222222

STOP PRESS - A320 ONLY:

TFN PLS ENSURE THAT THE ALT BRAKE CHECK IS CARRIED OUT ON EVERY ARRIVAL AND MAKE APPROPRIATE TECH LOG ENTRY.
(A320 FLT MGR 31.02.99)

BRITISH ISLES:
EGLL/LHR

PLATES PAGE 9 SHOWS MID 2J/2K SIDS. SHOULD READ MID 3J/3K. AUTHORITY ADVISED AND WILL BE AMENDED. (RTE PLNG 30.02.99)

URGENT///URGENT
A340

THERE HAS BEEN A REPORTED INCIDENT OF CONFLICTING FLIGHT DIRECTOR COMMANDS - CAPTAIN TO FLY IN ONE DIRECTION AND FO IN OPPOSITE DIRECTION ON DEPARTURE. THE INCIDENT OCCURRED ON 09R AT LHR ON A BPK 5J SID (CAPT TO FLY RIGHT, FO TO FLY LEFT). PLEASE EXERCISE CAUTION ON ALL DEPARTURES AND ENSURE THAT THE FLIGHT DIRECTORS COMMAND A TURN IN THE CORRECT DIRECTION. AIRBUS AND ALL AGENCIES HAVE BEEN INFORMED. AN INVESTIGATION BY COMPANY AND AIRBUS IS ACTIVE. FLEET NOTICE 99/99 REFERS.
(FLT SAFETY MGR + A340 FLEET MGR 31.02.99)

Note: The last item concerning A340 operations, which was received via an Air Safety Report, is clearly the sort of event to which crews need to be alerted quickly. It informs them of the basic circumstances surrounding the event and explains what action has been taken to start investigating the problem.

3.9.10 Flight Crew Notices

3.9.10.1 Detailed information is best disseminated through the medium of Flight Crew Notices. These are maintained in loose-leaf folders and divided into sections according to the particular subject (i.e. information specific to aircraft type or general information which is applicable to all fleets). Copies are distributed to all crew report centres and placed in the aircraft library for crew members to read when they have an opportunity (i.e. after a period of leave or other absence from duty), with a master copy being maintained by Flight Operations management. Email distribution of all notices is also another option currently in use.

3.9.10.2 Notices are withdrawn after the information contained has been incorporated into the appropriate Company publication (Ops Policy Manual, FCOM, Maintenance Manual, etc.) or have expired. The system must be maintained to ensure that out-of-date or superseded notices are removed.

3.9.10.3 An example of a Flight Crew Notice concerning the A340 event opposite provided in Appendix A. It shows the relationship between an Air Safety Report, Company NOTAM and a typical manufacturer's Flight Ops Telex. It also demonstrates the importance of prompt information exchange with the manufacturer.

3.10 LIAISON WITH OTHER DEPARTMENTS

3.10.1 The departmental structure of a commercial airline varies according to the type of operation. Whatever the type of operation, the Flight Safety Officer can expect to have direct input to all divisions of the Company over a period of time.

3.10.2 Routine 'business' generated through action and follow-up in the wake of a reported occurrence brings the Flight Safety Officer into formal contact with the department concerned. A Flight Safety Officer must foster trust and understanding; this is necessary in order to develop a flight safety culture, therefore an open-door policy coupled with a supportive, outgoing attitude is essential.

3.10.3 For example, by regularly visiting Crew Report and Engineering Control, Production and Development centres, effective working relationships with line pilots, cabin crew and line maintenance engineers become established and a free exchange of information, ideas and confidences is encouraged. In this way, feedback is obtained and something is occasionally learned which can be used to reduce hazards and thus enhance the safety of the operation as a whole.

3.10.4 A word of caution: ***Rumour cannot be processed***. For example, a pilot may voice strong views on the handling of simultaneous cross-runway operations at a particular airport or have been put at risk by a questionable ATC procedure; a ground engineer may highlight discrepancies in maintenance procedures, particularly where third-party work is involved. When such allegations are made the source should be invited to submit the facts - place, date, time, cause, effect, etc. - using the Air Safety Reporting system. Only then can the necessary research begin and, if warranted, measures implemented for change or improvement.

3.10.5 There are other (some perhaps less obvious) areas where working relationships will develop, usually as the result of a particular incident. The following are real examples:

- Cabin Crew Training: Quality, development and content of Safety Equipment and Procedures (SEP) training; interpretation of regulations; advice on applying procedures; incident reviews
- Commercial: Effect of schedules on crew fatigue; flight numbering confusion; passenger complaints alleging Company infringement of safety rules
- Legal and Insurance: Warranty claims; litigation following incidents
- Marketing: Unauthorised loading of duty-free sales goods
- Airport Services: Inadequate ground handling procedures; aircraft ground damage

- Cargo: Mishandling/loading of dangerous goods and general cargo
- Medical: Crew sickness on duty; passenger illness; deaths in flight
- PR: Preparation of press releases following an incident or accident
- Security Services: Events concerning violent passengers; aircraft sabotage

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SECTION 4 - HUMAN FACTORS

4.1 GENERAL

4.1.1 The following discussion is just one method of addressing Human Factors issues. Several other methods are available, including Boeing's Maintenance Decision Error Aid (MEDA) programme, ATA Specification 113, UK CAA Notice #71, and Human Factor Analysis and Classification System (HFACS) DOT/FAAAM-0/7. Also suggested for review is ICAO Digest No. 7 "Investigation of Human Factors in Accidents and Incidents".

4.1.2 Flight Safety is a main objective of the aviation. A major contributor to achieve that objective is a better understanding of Human Factors and the broad application of its knowledge. Increasing awareness of Human Factors in aviation will result in a safer and more efficient working environment.

4.1.3 The purpose of this chapter is to introduce this subject and to provide guidelines for improving human performance through a better understanding of the factors affecting it through the application of Crew Resource Management (CRM) concepts in normal and emergency situations and through understanding of the accident causation model.

4.2 THE MEANING OF HUMAN FACTORS

4.2.1 <u>Human Error</u>

4.2.1.1 The human element is the most flexible, adaptable and valuable part of the aviation system. But it is also the most vulnerable to influence, which can adversely affect its performance. Lapses in human performance are cited as causal factors in the majority of incidents/accidents, which are commonly attributed to "Human Error". Human Factors have been progressively developed to enhance the Safety of complex systems, such as aviation, by promoting the understanding of the predictable human limitations and its applications in order to properly manage the 'human error'. It is only when seeing such an error from a complex system viewpoint that we can identify the causes that lead to it and address those causes.

4.2.2 <u>Ergonomics</u>

4.2.2.1 The term "ergonomics" is derived from the Greek words "ergon" (work) and "nomos" (natural law). It is defined as "the study of the efficiency of persons in their working environment".

4.2.2.2 It is often used by aircraft manufacturers and designers to refer to the study of human-machine system design issues (e.g. Pilot-Cockpit, Flight Attendant - Galley, etc.). ICAO uses the term ergonomics in a broader context, including human performance and behaviour, thus synonymous with the term Human Factors.

4.2.3 The SHEL Model

4.2.3.1 To best illustrate the concept of Human Factors we shall use the SHEL model as modified by Hawkins. The name SHEL is derived from the initial letters of the model's components (Software, Hardware, Environment, and Liveware). The model uses blocks to represent the different components of Human Factors and is then built up one block at a time, with a pictorial impression being given of the need for matching the components.

When applied to the aviation world, the components will stand for:

S = Software	⇔	Procedures, manuals checklists, drills, symbology, etc.
H = Hardware	⇔	The File Aircraft and its components (e.g. seats, controls, lay-outs, etc.)
E = Environment	⇔	The situation in which the L-H-S should function (e.g. weather, working conditions, etc.)
L = Liveware	⇔	Human Element (you and other crew members, ground staff, ATC controller, etc.)

Aircrew work is a continuous interaction between those elements, and as in the following diagram matching those elements is as important as the characteristics of blocks themselves.

On a daily basis every staff member is the middle 'L' who has to interact with the other elements to form a single block. As such, any mismatch between the blocks can be a source of human error. Figure 4.1 illustrate the SHEL model.

THE SHEL MODEL AS MODIFIED BY HAWKINS

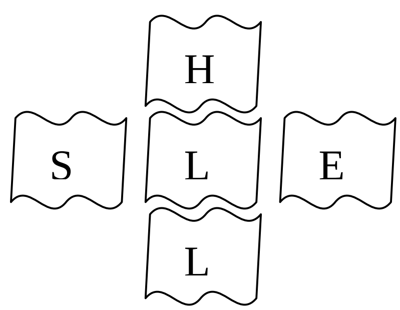

Figure 4.1

4.2.3.2 What is Human Factors?

- It studies people working together in concert with machines
- It aims at achieving safety and efficiency by optimising the role of people who's activities relate to complex hazardous systems such as aviation
- A multidisciplinary field devoted to optimising human performance and reducing human error
- It incorporates the methods and principles of the behavioural and social sciences, physiology and engineering

4.3 THE AIM OF HUMAN FACTORS IN AVIATION

4.3.1 By studying the SHEL model of Human Factors we notice that the 'Liveware' constitutes a hub and the remaining components must be adapted and matched to this central component. In aviation, this is vital, as errors can be deadly.

4.3.2 For that, manufacturers study the Liveware-Hardware interface when designing a new machine and its physical components. Seats are designed to fit the sitting characteristics of the human body, controls are designed with proper movement, instruments lay-out and information provided are designed to match the human being characteristics, etc.

4.3.2.1 The task is even harder since the Liveware, the human being, adapts to mismatches, thus masking any mismatch without removing it, and constituting as such a potential hazard. Examples of that are the 3 pointer altimeters, the bad seating lay-out in cabins that can delay evacuation, etc. It is current common practice for manufacturers to encourage airlines and professional unions to participate in the design phase of aircraft in order to cater for such issues.

4.3.3 The other component which continuously interact with the Liveware is the Software, i.e. all non-physical aspects of the system such as procedures, check-list lay out, manuals, and all what is introduced whether to regulate the whole or part of the SHEL interaction process or to create defences to cater for deficiencies in that process. Nevertheless, problems in this interface are often more tangible and consequently more difficult to resolve (e.g. misinterpretation of a procedure, confusion of symbology, etc…).

4.3.4 One of the most difficult interfaces to match in the SHEL model is the Liveware-Environment part. The aviation system operates within the context of broad social, political, economical and natural constraints that are usually beyond the control of the central Liveware element, but those aspects of the environment will interact in this interface. While part of the environment has been adapted to human requirements (pressurisation and air conditioning systems, sound-proofing, etc.) and the human element adapts to natural phenomena (weather avoidance, turbulence, etc.), the incidence of social, political and economical constraints is central on the interface and should be properly considered and addressed by those in management with enough power to alter the outcome and smooth the match.

4.3.5 The Liveware-Liveware interface represents the interaction between the human elements. Adding proficient and effective individuals together to form a group or a set of views does not automatically imply that the group will function in a proficient and effective way unless they can function as a team. For them to successfully do so we need leadership, good communication, crew-co-operation, teamwork and personality interactions. Crew Resource Management (CRM) and Line Oriented Flight Training (LOFT) are designed to accomplish that goal.

4.3.5.1 When advanced, CRM becomes Corporate or Company Resource Management, since staff/management relationships are within the scope of this interface, as corporate climate and company operating pressures can significantly affect human performance.

4.3.6 In brief, Human Factors in aviation aim at increasing the awareness of the human element within the context of the system and provide the necessary tools to perfection the match of the SHEL concept. By doing so it aims at improving safety and efficiency.

4.4 SAFETY & EFFICIENCY

4.4.1 Safety and efficiency are so closely interrelated that in many cases their influences overlap and factors affecting one may also affect the other. Human Factors have a direct impact on those two broad areas.

4.4.2 Safety is affected by the Liveware-Hardware interface. Should a change affect such interface the result might be catastrophic. In a particular aircraft accident, one causal factor cited in the report was that “variation in panel layout amongst the aircraft in the fleet had adversely affected crew performance”.

4.4.2.1 Safety is also affected by the Liveware-Software interface. Wrong information set in the date-base and unnoticed by the crew or erroneously entered by them can result in a tragedy. In a case where an aircraft crashed into terrain, information transfer and data entry errors were committed by navigation personnel and unchecked by Flight Crew were among the causal factors.

4.4.2.2 The Liveware-Liveware interface also plays a major role in Safety. Failure to communicate vital information can result in aircraft and life loss. In one runway collision, misinterpretation of verbal messages and a breakdown in normal communication procedures were considered as causal factors.

4.4.2.3 Finally, safety is affected by the Liveware-Environment interface. Such interface is not only limited to natural, social or economical constraints, it is also affected by the political climate which could lead to a tragedy beyond the control of the Aircrew. The most famous illustration of such a tragedy is the loss of Pan-Am 101 over Lockerbie in 1988. An airworthy aircraft which “had been maintained in compliance with the regulations” and flown by “properly licensed and medically fit crew” disintegrated in-flight due to “the detonation of an improvised explosive device located in a baggage container”. (AAIB Aircraft Accident Report 2/90, U.K.). As a result of that crash latent failures present in the aviation security system at airports and within the airlines were identified, regulations and procedures were redefined to address those failures and avoid their re-occurrence.

4.4.3 Efficiency is also directly influenced by Human Factors and its application. In turn it has a direct bearing on safety.

- For instance, motivation constitutes a major boost for individuals to perform with greater effectiveness, which will contribute to a safe operation.
- Properly trained and supervised crewmembers working in accordance to SOPs are likely to perform more efficiently and safely.
- Cabin crew understanding of passengers behaviour and the emotions they can expect on board is important in establishing a good relationship which will improve the efficiency of service, but will also contribute to the efficient and safe handling of emergency situations.
- The proper layouts of displays and controls in the cockpit enhances Flight Crew efficiency while promoting safety.

4.5 FACTORS AFFECTING AIRCREW PERFORMANCE

4.5.1 Although the human element is the most adaptable component of the aviation system that component is influenced by many factors which will affect human performance such as fatigue, circadian rhythm disturbance, sleep deprivation, health and stress. These factors are affected by environmental constraints like temperature, noise, humidity, light, vibration, working hours and load.

4.5.2 <u>Fatigue</u>

4.5.2.1 Fatigue may be physiological whenever it reflects inadequate rest, as well as a collection of symptoms associated with disturbed or displaced biological rhythms. It may also be psychological as a result of emotional stress, even when adequate physical rest is taken. Acute fatigues are induced by long duty periods or an accumulation of particularly demanding tasks performed in a short period of time. Chronic fatigue is the result of cumulative effects of fatigue over the longer term. Temperature, humidity, noise, workstation design and Hypoxia are all contributing factors to fatigue.

4.5.3 <u>Circadian Rhythm Disturbance</u>

4.5.3.1 Human body systems are regulated on a 24-hour basis by what is known as the circadian rhythm. This cycle is maintained by several agents: day and night, meals, social activities, etc. When this cycle is disturbed, it can negatively affect safety and efficiency.

4.5.3.2 Circadian rhythm disturbance or circadian dysrhythmia is not only expressed as jet lag resulting from long-haul flights were many time zones are crossed, but can also result from irregular or night scheduled short-haul flights.

4.5.3.3 Symptoms of circadian dysrhythmia include sleep disturbance, disruption of eating and elimination habits, lassitude, anxiety and irritability. That will lead to slowed reaction, longer decision making times, inaccuracy of memory and errors in computation which will directly affect operational performance and safety.

4.5.4 <u>Sleep deprivation</u>

4.5.4.1 The most common symptom of circadian dysrhythmia is sleep disturbance. Tolerance to sleep disturbance varies between individuals and is mainly related to body chemistry and emotional stress factors. In some cases sleep disturbance can involve cases of over-all sleep deprivation. When that stage is reached it is called Situational Insomnia, i.e. it is the direct result of a particular situation. In all cases, reduced sleep will result in fatigue.

4.5.4.2 Some people have difficulty sleeping even when living in normal conditions and in phase with the circadian rhythm. Their case is called Clinical Insomnia. They should consult a medical doctor and refrain from using drugs, tranquillisers or alcohol to induce sleep, as they all have side effects which will negatively affect their performance and therefore the safety of flights.

4.5.4.3 To overcome problems of sleep disturbance one should adapt a diet close to his meal times, learn relaxation techniques, optimise the sleeping environment, recognise the adverse effects of drugs and alcohol and be familiar with the disturbing effects to circadian dysrythmia to regulate his sleep accordingly.

4.5.5 Health

4.5.5.1 Certain pathological conditions (heart attacks, gastrointestinal disorders, etc.) have caused sudden pilot incapacitation and in rare cases have contributed to accidents. But such incapacitation is usually easily detectable by other crewmembers and taken care of by applying the proper procedures.

4.5.5.2 The more dangerous type is developed when a reduction in capacity results in a partial or subtle incapacitation. Such incapacitation may go undetected, even by the person affected, and is usually produced by fatigue, stress, the use of some drugs and medicines and certain mild pathological conditions such as hypoglycemia. As a result of such health conditions, human performance deteriorates in a manner that is difficult to detect and therefore, has a direct impact on flight safety.

4.5.5.3 Even though aircrew are subjected to regular periodical medical examinations to ensure their continuing health, that does not relieve them from the responsibility to take all necessary precautions to maintain their physical fitness. It hardly needs to be mentioned that fitness will have favourable effects on emotions, reduces tension and anxiety and increases resistance to fatigue. Factors known to positively influence fitness are exercise, healthy diet and good sleep/rest management. Tobacco, alcohol, drugs, stress, fatigue and unbalanced diet are all recognised to have damaging effects on health. Finally, it is each individual responsibility to arrive at the workplace “fit to fly”.

4.5.6 Stress

4.5.6.1 Stress can be found in many jobs, and the aviation environment is particularly rich in potential stressors. Some of these stressors have accompanied the aviation environment since the early days of flying, such as weather phenomena or in-flight emergencies, others like noise, vibration and G Forces have been reduced with the advent of the jet age while disturbed circadian rhythms and irregular night flying have increased.

4.5.6.2 Stress is also associated with life events which are independent from the aviation system but tightly related to the human element. Such events could be sad ones like a family separation, or happy ones like weddings or childbirth. In all situations, individual responses to stress may differ from a person to another, and any resulting damage should be attributed to the response rather than the stressor itself.

4.5.6.3 In an aircrew environment, individuals are encouraged to anticipate, recognise and cope with their own stress and perceive and accommodate stress in others, thus managing stress to a safe end. Failure to do so will only aggravate the stressful situation and might lead to problems.

4.6 PERSONALITY VS. ATTITUDE

4.6.1 Personality traits and attitudes influence the way we behave and interact with others. Personality traits are innate or acquired at a very young age. They are deep-rooted, stable and resistant to change. They define a person and classify him/her (e.g. ambitious, dominant, aggressive, mean, nice, etc.).

4.6.2 On the contrary, attitudes are learned and enduring tendencies or pre-dispositions to respond in a certain way, the response is the behaviour itself. Attitudes are more susceptible to change through training, awareness or persuasion.

4.6.3 The initial screening and selection process of aircrew aims at detecting undesired personality characteristics in the potential crewmember in order to avoid problems in the future.

4.6.3.1 Human Factors training aims at modifying attitudes and behaviour patterns through knowledge, persuasion and illustration of examples revealing the impact of attitudes and behaviour on flight safety. That should allow the aircrew to make rapid decisions on what to do when facing certain situations.

4.7 CREW RESOURCE MANAGEMENT (CRM)

4.7.1 CRM is a practical application of Human Factors. It aims at teaching crew members how to use their interpersonal and leadership styles in ways that foster crew effectiveness by focusing on the functioning of crew members as a team, not only as a collection of technically competent individuals, i.e. it aims at making aircrew work in “Synergy” (a combined effect that exceeds the sum of individual effects).

4.7.2 Changes in the aviation community have been drastic throughout this century: the jet age, aeroplane size, sophisticated technology, deregulation, hub and spokes, security threats, industrial strikes and supersonic flights. In every one of those changes some people saw a threat, it made them anxious, even angry sometimes.

4.7.2.1 When first introducing CRM some people might see a threat, since it constitutes a ‘change’. However, with the majority of accidents having lapses in human performance as a contributing causal factor, and with nearly two decades of CRM application in the international aviation community revealing a very positive feedback, we see this ‘change’ as “strength”.

4.7.3 CRM can be approached in many different ways, nevertheless there are some essential features that must be addressed: The concept must be understood, certain skills must be taught and inter-active group exercises must be accomplished.

4.7.4 To understand the concept one must be aware of certain topics as synergy, the effects of individual behaviour on the team work, the effect of complacency on team efforts, the identification and use of all available resources, the statutory and regulatory position of the pilot-in-command as team leader and commander, the impact of company culture and policies on the individual and the interpersonal relationships and their effect on team work.

4.7.5 Skills to be developed include:

- **Communication skills**
  Effective communication is the basis of successful teamwork. Barriers to communication are explained, such as cultural difference, rank, age, crew position, and wrong attitude. Aircrews are encouraged to overcome such barriers through self-

esteem, participation, polite assertiveness, legitimate avenue of dissent and proper feedback.

- **Situational Awareness**
  Total awareness of surrounding environment is emphasised so is the necessity from the crewmember to differentiate between reality and perception of reality, to control distraction, enhance monitoring and cross-checking and to recognise and deal with one's or others incapacitation, especially when subtle.

- **Problem Solving and Decision Making**
  That skill aims at developing conflict management within a time constraint. A conflict could be immediate or ongoing, it could require a direct response or certain tact to cope with it. By developing Aircrew judgement within a certain time frame, we develop skills required to bring conflicts to safe ends.

- **Leadership**
  In order for a team to function efficiently it requires a leader. Leadership skills derive from authority but depend for their success on the understanding of many components such as managerial and supervisory skills that can be taught and practised, realising the influence of culture on individuals, maintaining an appropriate distance between team members enough to avoid complacency without creating barriers, care for one's professional skill and credibility, the ability to hold the responsibility of all crew members and the necessity of setting the good example. The improvement of these skills will allow the team to function more efficiently by developing the leadership skills required to achieve a successful and smooth followership in the team.

- **Stress Management**
  Commercial pressure, mental and physical fitness to fly, fatigue, social constraints and environmental constraints are all part of our daily life and they all contribute in various degrees to stress. Stress management is about recognising those elements, dealing with one's stress and help others manage their own. It is only by accepting things that are beyond our control, changing things that we can and knowing the difference between both that we can safely and efficiently manage stress.

- **Critique**
  Discussion of cases and learning to comment and critique actions are both ways to improve one's knowledge, skills and understanding. Review of actual airlines accidents and incidents to create problem-solving dilemmas that participant Aircrew should act-out and critique through the use of feed-back system will enhance crew members awareness of their surrounding environment, make them recognise and deal with similar problems and help them solve situations that might occur to them.

4.7.6 Finally, for a CRM program to be successful it must be embedded in the total training programme, it must be continuously reinforced and it must become an inseparable part of the organisations culture. CRM should thus be instituted as a regular part of periodical training and should include practice and feedback exercises such as complete crew LOFT exercises.

4.7.7 Line Oriented Flight Training (LOFT)

4.7.7.1 LOFT is considered to be an integral part of CRM training, where the philosophy of CRM skills is reinforced. LOFT refers to aircrew training which involves a full mission simulation of situations which are representative of line operations, with emphasis on situations which involve communication, management and leadership. As such it is considered as a practical application of the CRM training and should enhance the principles developed therein and allow a measurement of their effectiveness.

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SECTION 5 - ACCIDENT/INCIDENT INVESTIGATION & REPORTS

5.1 DEFINITIONS

- **Accident**: An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which a person is fatally or seriously injured as a result of:

  - Being in the aircraft
  - Direct contact with any part of the aircraft, including parts which have become detached from the aircraft
  - Direct exposure to jet blast

  except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew, or

- The aircraft sustains damage or structural failure which:

  - Adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component,

  except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers ,wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

  - The aircraft is missing or completely inaccessible.

- **Causes:** Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident.

- **Incident:** An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

- **Investigation:** A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

- **Investigator-in-charge:** A person, commission or other body charged, on the basis of his/her/their qualifications, with the responsibility for the organisation, conduct and control of an investigation.

- **Serious incident:** An incident involving circumstances indicating that an accident nearly occurred. The difference between an accident and a serious incident lies only in the result.

5.2 POLICY

5.2.1 All incidents are investigated through follow-up of occurrences. It should be part of operational policy to conduct an in-house independent & formal investigation following an accident or incident even though it may also be the subject of a Government investigation. A Government investigation can become a protracted affair, whereas the airline needs to ascertain quickly whether any immediate changes in procedures are necessary. Also, the airline may be asked to investigate and make a report on the Government agency's behalf

5.2.2 Internal accident/incident investigations are carried out under the authority of the CEO by the Flight Safety Officer.

5.2.3 This handbook suggests a suitable procedure for the conduct of an internal investigation commensurate with our divisional structure. The procedure should be standardised and outlined in the Company General Operations Manual.

5.3 OBJECTIVES

5.3.1 The investigation should seek to determine not only the immediate causes, but the underlying causes and inadequacies in the safety management system.

5.3.2 The appropriate prevention and intervention procedures should then be developed and remedial action is taken.

5.3.3 Clearly detailed investigation of each accident/incident concentrates on the way the key aspects of accident causation are inherently interrelated with the accident/incident.

5.4 INCIDENT/ACCIDENT NOTIFICATION

5.4.1 <u>Incident Notification & Investigation</u>

5.4.1.1 An aircraft incident can be defined as any occurrence, other than an accident, which places doubt on the continued safe operation of the aircraft and:

- Has jeopardised the safety of the crew, passengers or aircraft but which has terminated without serious injury or substantial damage
- Was caused by damage to, or failure of, any major component not resulting in substantial damage or serious injury but which will require the replacement or repair of that component
- Has jeopardised the safety of the crew, passengers or aircraft and has avoided being an accident only by exceptional handling of the aircraft or by good fortune
- Has serious potential technical or operational implications
- Causes trauma to crew, passengers or third parties
- Could be of interest to the press and news media

5.4.1.2 Examples include loss of engine cowlings, portions of flap or control surfaces, items of ancillary equipment or fuselage panels; an altitude excursion or other air traffic violation; a minor taxiing accident; damage due to collision with ground equipment.

5.4.1.3 In collaboration with other management staff the Flight Safety Officer will need to devise a procedure for containing such incidents within Flight Operations.

5.4.2 Accident Notification & Investigation

5.4.2.1 Aircraft accident investigation is a highly specialised discipline and a dedicated profession, and full Company emergency procedures in the wake of an accident are not the Flight Safety Officer's responsibility. It is therefore outside the scope of this handbook to cover both subjects completely. However, the Flight Safety Officer must have a good understanding of the procedures involved. **When any accident occurs - and this does not necessarily mean a hull loss involving loss of life - the Flight Safety Officer will be seen as the person who knows what to do**.

5.4.2.2 In most States' regulations, a duty is placed upon the Commander of an aircraft or, if the Commander has been killed or incapacitated, upon the operator to notify an aircraft accident to the appropriate Government investigating authority. **For practical purposes, this becomes the Flight Safety Officer's responsibility**.

5.4.3 International Investigations

5.4.3.1 When an aircraft operated by one State crashes in a foreign State, the procedures involving investigation are set out in Annex 13 to the ICAO Convention. The procedures are complex, but the basic points are:

- The two countries can agree on a procedure not specifically covered in Annex 13
- The State in which the accident occurs always has the right to appoint a person to conduct the investigation and prepare the subsequent accident report. If the accident occurs in international waters then this right reverts to the State of registry of the aircraft
- The State of registry has the right to send an accredited representative to participate in the investigation. This person is authorised to be accompanied by advisers who may represent the aircraft operator, the manufacturer or employee trade unions;
- The State of registry is obliged to provide the State of occurrence with information on the aircraft, its crew and its flight details
- The accredited representative and any advisers should be entitled to:

  - Visit the scene of the accident
  - Examine the wreckage
  - Question witnesses
  - Gain access to all relevant evidence
  - Receive copies of all pertinent documents
  - Make submissions to the investigation
  - Receive a copy of the final report

- There is no entitlement for the State of registry to take part in the analysis of the accident or the development of its cause(s). This is the right of the State conducting the investigation.

5.4.3.2 Being mindful of any changes to the provisions of ICAO Annex 13, the Flight Safety Officer could certainly be expected to become involved in several items above.

5.4.4 All staff have the responsibility to report an incident to the Operations Control Centre or other company required contact point by the most expeditious way.

5.4.5 In case of reportable incidents, an investigation will commence at the earliest possible opportunity and shall be undertaken by the responsible line manager.

5.4.6 The DFDR and/or CVR may be removed from the aircraft if it is believed that the data may contribute to the investigation of an incident or accident.

5.4.7 The Operations Control Manager on-duty shall inform all concerned as per the emergency group list provided, whenever an accident or serious incident occurs (see flowchart in 5.5)

5.4.8 The Operations Control Manager on-duty shall inform the Flight Safety Officer or his alternate on duty whenever an ASR is received by fax.

5.4.9 It is the operator's duty to notify the appropriate authorities.

5.4.9.1 When safety violations by ground service personnel occur (e.g. opening of cargo doors with engines running, ramp manoeuvring traffic violations, misuse of ground support equipment, etc.), the ramp safety expert will normally assume the principal role in any investigation and follow-up.

5.4.9.2 In order to instigate appropriate action, Aircraft Commanders are requested to:

- If in communication with ATC, advise of any incidents
- Complete an Air Safety Report
- Inform Flight Operations as soon as possible by the most expeditious means

5.5 INCIDENT/ ACCIDENT EXAMPLE GROUP FLOWCHART & LIST OF RESPONSIBILITIES

AUTHORITY	DEALS WITH	NOMINATED PERSON	PHONE No.
Director of Operations (Crisis Manager)	Commercial dept. Press & media Customer relations, Legal dept., Insurance dept	+ alternate(s)	Normal(s) Mobile(s) Pager(s)
Director of Engineering	Commercial dept., Legal dept., Insurance dept.	As above.	As above.
Chief Pilot	Regulatory authorities, Flight crew information	As above.	As above.
Flight Safety Officer	Investigation, crew documentation & information, internal & external liaison	As above.	As above.
Administration Manager	Security dept., company emergency procedure	As above.	As above.
Fleet Manager	Crew welfare, operational analysis, MEL procedures	As above.	As above.
Engineering Manager	Engineering analysis, MM procedures	As above.	As above.
Flight Operations Manager	Operations status, communications	As above.	As above.
Human Resources Manager	Personnel records & welfare	As above.	As above.
Chief Cabin Crew	Cabin crew information & welfare, cabin procedures	As above.	As above.
Aircraft Commander	Communication with Flt. Ops Control Centre, Filing ASR, Documentation, preserving evidence, pax & crew welfare	Liases with local authorities & support agencies.	No comments to press or media.
Public Relations Representative	Press & media	As above.	As above.

5.6 INCIDENT/ACCIDENT INVESTIGATION PROCEDURE

5.6.1 In case of accident or serious incident, and whenever the operator decides that an investigation into an incident is required, the Flight Safety Officer who heads the safety department/section shall decide on the level of the investigation.

The Investigator-in-charge could be one of the following:

- Flight Safety Officer
- An air safety investigator representing him
- Delegate(s) from Flight Operations and/or Engineering and Maintenance, or an investigating committee headed by the Flight Safety Officer or the air safety investigator representing him, in which Flight Operations and Engineering & Maintenance are represented by persons who could be from the fleet/section involved in the incident, but who do not have direct influence on the operating process (i.e. not the fleet or training manager, etc)

5.6.2 A trade representative of the concerned association can attend the appropriate interviews and the investigation process as an observer provided he/she maintains confidentiality and refrain from releasing any information. Should he/she have any reservation he/she should raise it with the investigator-in-charge or with the head of the investigation committee. If not satisfied he/she can raise it to the Accountable Manager.

5.6.3 The investigator-in-charge should investigate and report to the accountable manager any aspect considered to be relevant to an understanding of the incident by examining the circumstances surrounding the incident in order to discover the likely latent and active causes that lead to it.

5.6.4 The investigation report should then be reviewed with the Flight Operations and Engineering & Maintenance post holders and all safety recommendations should be implemented. However, if a safety recommendation is not considered necessary by a post holder, he/she should so state to the accountable manager and to the investigator-in-charge the reason(s) for rejecting it. The accountable manager has final authority.

5.7 PREPARATION

5.7.1 As soon as a notification of an incident/accident is received, it is the duty of the Flight Safety Officer to ensure that all relevant documents are gathered and made available for reference. This list is not exhaustive, but will typically include, as appropriate:

- The original Air Safety Report
- Crew statements
- Crew license details and training records
- Witness statements
- Photographs
- Flight documentation (navigation log, weight and balance information, etc)
- Operating/maintenance manuals and checklists

5.7.2 Obtain also, if appropriate:

- All relevant DFDR printouts and CVR transcripts
- ATC voice tapes or transcripts
- ATC radar transcript

5.8 ACCIDENT INVESTIGATION REPORT

5.8.1 The investigator-in-charge report should be written under the following suggested headings, as per the ICAO Annex 13 Appendix:

1. FACTUAL INFORMATION

1.1 History of the flight. A brief narrative giving the following information:
- Flight number, type of operation, last point of departure, time of departure (local time or UTC), point of intended landing.
- Flight preparation, description of the flight and events leading to the accident, including reconstruction of the significant portion of the flight path, if appropriate.
- Location (latitude, longitude, elevation), time of the accident (local time or UTC), whether day or night.

1.2 Injuries to persons. Completion of the following (in numbers):

Injuries	*Crew*	*Passengers*	*Other*
Fatal			
Serious			
Minor/None			

Note: Fatal injuries include all deaths determined to be a direct result of injuries sustained in the accident. Serious injury is defined in Chapter 1 of Annex 13.

1.3 Damage to aircraft. Brief statement of the damage sustained by aircraft in the accident (destroyed, substantially damaged, slightly damaged, no damage).

1.4 Other damage. Brief description of damage sustained by objects other than the aircraft.

1.5 Personnel information.

a) Pertinent information concerning each of the flight crewmembers including: age, validity of licenses, ratings, mandatory checks, flying experience (total and on type) and relevant information on duty time.
b) Brief statement of qualifications and experience of other crewmembers.
c) Pertinent information regarding other personnel, such as air traffic services, maintenance, etc., when relevant.

1.6 Aircraft information.
a) Brief statement on airworthiness and maintenance of the aircraft (indication of deficiencies known prior to and during the flight to be included, if having any bearing on the accident).
b) Brief statement on performance, if relevant, and whether the mass and centre of gravity were within the prescribed limits during the phase of operation related to the accident. (If not, and if of any bearing on the accident give details).
c) Type of fuel used.

1.7 Meteorological information:
a) Brief statement on the meteorological conditions appropriate to the circumstances including both forecast and actual conditions, and the availability of meteorological information to the crew.
b) Natural light conditions at the time of the accident (sunlight, moonlight, twilight, etc.).

1.8 Aids to navigation. Pertinent information on navigation aids available, including landing aids such as ILS, MLS, NDB, PAR, VOR, visual ground aids, etc., and their effectiveness at the time.

1.9 Communications. Pertinent information on aeronautical mobile and fixed service communications and their effectiveness.

1.10 Aerodrome information. Pertinent information associated with the aerodrome, its facilities and condition, or with the take-off or landing area if other than an aerodrome.

1.11 Flight recorders. Location of the flight recorder installations in the aircraft, their condition on recovery and pertinent data available therefrom.

1.12 Wreckage and impact information. General information on the site of the accident and the distribution pattern of the wreckage; detected material failures or component malfunctions. Details concerning the location and state of the different pieces of the wreckage are not normally required unless it is necessary to indicate a break-up of the aircraft prior to impact. Diagrams, charts and photographs may be included in this section or attached in the appendices.

1.13 Medical and pathological information. Brief description of the results of the investigation undertaken and pertinent data available therefrom.

Note: Medical information related to flight crew licenses should be included in 1.5 Personnel Information.

1.14 Fire. If fire occurred, information on the nature of the occurrence, and of the firefighting equipment used and its effectiveness.

1.15 Survival aspects. Brief description of search, evaluation and rescue, location of crew and passengers in relation to injuries sustained, failure of structures such as seats and seat-belt attachments.

1.16 Tests and research. Brief statements regarding the results of tests and research.

1.17 Organisational and management information. Pertinent information concerning the organisations and their management involved in influencing the operation of the aircraft. The organisations include, for example, the operator; the air traffic services, airway, aerodrome and weather service agencies; and the regulatory authority. The information could include, but not be limited to, organisational structure and functions, resources, economic status, management policies and practices, and regulatory framework.

1.18 Additional information. Relevant information not already included in 1.1 to 1.17 above.

1.19 Useful or effective investigation techniques. When useful or effective investigation techniques have been used during the investigation, briefly indicate the reason for using these techniques and refer here to the main features as well as describing the results under the appropriate subheadings 1.1 to 1.18.

2. ANALYSIS

Analyse, as appropriate, only the information documented in 1. - Factual information and which is relevant to the determination of conclusions and causes.

3. CONCLUSIONS

List the findings and causes established in the investigation. The list of causes should include both the immediate and the deeper systemic causes.

4. SAFETY RECOMMENDATION

As appropriate, briefly state any recommendations made for the purpose of accident prevention and any resultant corrective action.

APPENDICES

Include, as appropriate, any other pertinent information considered necessary for the understanding of the report.

Note: All the above should be included in the report in the same sequence. If not relevant to the accident/incident they should be included and the term not relevant mentioned next to them whenever appropriate.

5.9 ACCIDENT INVESTIGATOR'S KIT

5.9.1 An investigator's kit should always be available in the company to be used by all Air Safety Investigator's whenever they are exercising their duties. It should contain at least the following:

Clothing & Personal Items:

- Personal Protective Equipment (PPE Disposable)
- Personal Protective Equipment (Non-Disposable)
- Waterproof trousers and overjackets
- Coveralls
- Fluorescent tabards
- Vinyl gloves
- Industrial work gloves
- Industrial work boots
- Rubber boots
- Face masks
- Woollen hats
- Lightweight overjackets and trousers

- Passport & extra photos
- Tickets
- Credit cards
- Immunisation records
- Cash, traveller's cheques, and/or letter of credit
- Business cards
- Travel authorisation
- Medical kit
- Sun/reading/safety glasses
- Insect repellent
- Toiletries
- Towelettes

Stationery:

- Clipboards
- Waterproof coloured marker pens
- Felt-tipped pens, ball pens and pencils
- Assorted clear plastic envelopes
- Pocket notepads
- Staplers and spare staple packs
- Assorted office envelopes
- Tie-on labels
- String (500m)
- Map or plan of area - preferably highly detailed with topographic information
- Company Emergency Procedures manual
- File folder
- Chalk
- Eraser
- Cellophane tape
- Paperclips & rubber bands
- Pins
- Ruler

Hardware:

- Torches (Flashlights) and spare batteries
- Battery-mains tape recorder
- Camera - Polaroid or digital, with spare film/memory
- Camera - 35mm roll-film camera with flashgun and spare film
- Camera - video
- Mobile UHF radios with spare battery packs and charger unit
- 100-metre measuring tape
- Valises for carrying equipment
- Labels and Signs
- Cellular Phone - modem capable with spare battery packs
- Laptop with fax and e-mail modem with spare battery packs
- Calculator
- Compass

- Binoculars
- Knife
- Telephone lists
- Matches
- Can opener
- Plotter
- Padlock
- Mirror
- Tape measure
- Magnifying glass
- Water container & cup
- Whistle
- Tools
- Plastic bags & ties
- Magnet

Important Note: Personal Protective Equipment (PPE) is mandatory in the USA and Canada. PPE must be worn to protect investigators on site from blood-borne pathogens. PPE training must be received prior to its use. Investigators not equipped with appropriate PPE will not be permitted to enter the accident site.

5.9.2 Investigator Departure Checklists

<u>Briefings</u>
Accident
Locale & weather
Rendezvous location & contact info
Management and legal
Trip duration
Personal security (as req'd)

<u>Travel plans</u>
Make reservations (always get round trip tickets
Money, traveller's checks, credit cards
Paycheque disposition

<u>Visa</u>
Learn if required (travel office or airline can advise)
Delay if necessary
Medical items
Get travel medical kit
Doxycyclene
Personal medications
Hand-carry valuables and essentials
Check remaining luggage (label inside & outside)
Use "Go Kit" Checklist
Cancel Appointments
Business
Personal
Medical

5.9.2 All accident investigators should have received the HBV vaccination and completed the Bloodborne Pathogens training program.

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SECTION 6 - EMERGENCY RESPONSE & CRISIS MANAGEMENT

6.1 GENERAL

6.1.1 Because commercial air transport operations are based almost entirely on public confidence, any accident has a significant impact. Even those organisations that do not cater to external customers operate within a mutual trust agreement between the pilots, mechanics, schedulers and management. A major accident which results in a hull loss, human suffering and loss of life inevitably undermine the customer's confidence in aviation as a whole, but the organisation(s) involved will suffer the most. For these reasons, it is vital for every aviation organisation to implement and develop contingency plans to deal with and manage a crisis effectively.

6.1.2 Past accidents have highlighted the fact that many organisations do not have effective plans in place to manage a post-accident crisis. This may be due to either lack of resources or a proper organisational structure, or a combination of both factors. The aim of this section is to provide practical guidelines for developing and implementing a crisis management plan.

Note: However, due to differences in corporate structures and organisational requirements, those guidelines should be further developed by each operator in order to adapt them to the organisation's needs and resources. Refer to the IATA Emergency Response Manual (planned for release by the end of 2000).

6.1.3 In a developing organisation the Flight Safety Officer may be tasked with planning the company's emergency response and crisis management procedures. In larger, established organisations these procedures are usually the responsibility of a dedicated Emergency Planning department. The development of these procedures is a highly specialised and time-consuming task; therefore, serious consideration should be given to engaging external resources.

6.1.4 All procedures, including local airport emergency plans at route stations, must be promulgated in a dedicated company Emergency Procedures Manual that is distributed selectively throughout the network. This should include procedures of code-sharing and alliance partners. Individuals who have responsibilities following a major accident or who are liable to become involved in the aftermath are obliged to keep themselves apprised of its contents. The emergency response plan should be exercised at regular intervals to ensure its completeness and suitability (both full and table top exercises).

6.1.5 Tens of thousands of public enquiry telephone calls can be expected if the accident occurs to a relatively well known airline. Smaller airlines, cargo carriers and corporate entities may find much less trouble with phone calls and media enquiries. The Company may, therefore, be required to provide or contract for toll-free lines to receive public calls and also ensure that an adequate number of trained staff can be made available to respond. The Company web-site should consider having a link to only deal with information regarding this event. Consideration should be given to setting up a separate web-site for this function alone. This information should be controlled and administered through the CMC. Large national carriers who have specialised emergency response centres may be willing to provide a contracted service for public telephone enquiries and liaison with the authorities.

6.2 RESPONSIBILITIES

6.2.1 Although an organisation may have in place a procedure to be followed in the event of becoming involved in an accident or incident (as in the example Flight Operations procedure in Section 5.5), it is often the case that little thought is given to the after-effects of a fatal accident on the whole Company, particularly with small organisations.

6.2.2 **Airports**: ICAO Annex 14 states that before operations commence at an airport an emergency plan should be in place to deal with an aircraft accident occurring on or in the vicinity of the airport. If an organisation utilises these ICAO member airports, the following plan would be available to be viewed by those organisations wishing to do so. This plan, in addition to specifying the airport authority's role, must show the details of any local organisation that could assist and would include, for example:

- Police, fire and ambulance services
- Hospitals and mortuaries
- Armed (military) services
- Religious and welfare organisations (i.e. Red Cross/Red Crescent)
- Transport and haulage contractors
- Salvage companies
- Foreign embassies, consulates and legations

6.2.3 The airport authority normally should establish an Emergency Co-ordination Centre (ECC) through which all post-accident activities are organised and controlled. It will also provide a reception area to temporarily house survivors, their family and friends.

6.2.4 Flight Operations: It is the organisation's responsibility to maintain familiarity with emergency plans at all airports into which it operates. If an accident occurs, senior representatives of the airline(s)/organisation(s) concerned must report to the airport's ECC to co-ordinate its activities with the airport authority and representatives of all other agencies responding.

6.2.5 The organisation's own emergency response procedures will be implemented immediately.

6.2.6 The airline or flight operations organisation is responsible for:

- Removal and salvage of the aircraft and any wreckage
- Providing information on any dangerous goods carried as cargo on board the aircraft
- Co-ordination of media coverage relating to the incident
- Notifying local Customs, Immigration and Postal authorities
- Victim support. A senior organisation official must be made responsible for:
    - Directing relatives to the designated survivor's reception area
    - Providing overnight accommodation as required
    - Being in attendance at hospitals to provide assistance for accident victims
    - Notifying survivors' next-of-kin, other family members and friends
    - Making arrangements for transporting relatives to a location near the accident site
    - Returning deceased victim's remains to the country of domicile

Note: In some States, an airline involved in an accident is also responsible for notifying the deceased's next-of-kin.

6.2.7 To fulfil the above responsibilities the organisation must establish and equip:

- A Crisis Management Centre (CMC) at HQ
- A Local Incident Control Centre (LICC) at the airport to co-ordinate activities with HQ and the airport authority's Emergency Control Centre
- A mobile support and investigation team

6.3 EXAMPLE OF A COMPANY EMERGENCY RESPONSE ORGANISATION

6.3.1 In the event of an accident there are basically three areas of response:

- HQ - activation of the company's Crisis Management Centre
- Local - activation of the LICC in conjunction with the airport's ECC
- Mobile - activation and dispatch of the company's Incident Support Team

6.3.2 Crisis Management Centre: Secure HQ office space will need to be allocated to house a CMC, which may be sub-divided into:

- Incident Control Centre (ICC)
- Media Information Centre (MIC)
- Passenger Information Centre (PIC)
- LICC (Local Incident Control Centre) liaison
- Engineering liaison

6.3.3 The CMC team for a passenger airline will typically consist of:

- CEO
- Director of Operations (who may be designated in-command)
- Commercial Director
- Marketing Director
- Director of Support Services (i.e. legal, insurance and administration)
- Head of Safety
- Head of Security
- Head of Engineering
- Head of Public Relations
- Head of Customer Relations

7.3.4 The CMC is responsible for co-ordinating all external and internal information, communication and response to the accident. It will:

- Arrange any special flights required
- Brief and dispatch the mobile support team
- Respond to public enquiries
- Prepare statements to the media
- Liase with the accident site and nearest airport to the site

- Collect and analyse all relevant information concerning the possible cause of the accident, its consequences and casualty assessment

6.3.5 In addition to office furniture and stationary supplies the CMC must be equipped with:

- An ARINC/SITA facility with a dedicated address
- Sufficient telephones and fax machines (unlisted) for all users
- PC equipment
- Investigation and field kit for issue to the mobile response team
- All relevant company manuals
- Internal and external telephone directories
- Accurate wall clocks to indicate the time in UTC, at HQ and at the accident site
- Televisions tuned to an all-news channel and an all-weather channel
- Aeronautical charts

6.3.6 The CMC must be maintained in a constant state of preparedness. It should be borne in mind that once activated, the CMC will require 24-hour manning for an unspecified period, and therefore alternative members should be nominated to provide shift coverage.

6.3.7 Local Incident Control Centre: This will be an extension of the Station Manager's (or handling agent's) office at the incident airport and must be equipped with adequate communications facilities for liaison with the CMC and the airport Emergency Control Centre. It will be necessary to reinforce the station's staff in order to man the LICC on a shift basis in addition to maintaining routine operations. In the early stages this can be accomplished by utilising off-duty personnel until the mobile team arrives.

6.3.8 Mobile Investigation and Support Team will be made up of:

- Flight Safety Officer or representative
- Engineering specialist(s)
- Representative for aircraft type fleet and/or Training Manager (ideally both)
- Volunteers who can support staff at the incident airport in the handling of the incident (LICC duties, for example) and assist with maintaining normal operations plus members of the State's air accident investigating authority and victim identification team (see the notes at the end of this section).

6.3.9 The Mobile Support and Investigation Team will travel by the fastest possible means and must be prepared for an extended period of absence. They must also be equipped for work in the field (refer to Section 5.9).

6.4 RESPONSE GUIDELINES

6.4.1 Flight Operations Control will most likely receive first notification of an accident. Keep in mind; first notification of an accident may come from someone totally disassociated with the primary organisation involved. Quite often, the first notification has been from the media or a news reporter. Call-out of key personnel must then be initiated beginning with the members of the CMC. This in turn leads to a call-out cascade to all other people and organisations involved.

6.4.2 The media cannot and must not be treated curtly or rudely. The first inquiries by the media may catch organisation personnel off-guard and may seem prying or over-zealous, however reporters may be referred to the organisation spokesperson, or a simple statement may suffice temporarily, such as:

> "*We have just received word concerning one of our aircraft being involved in an incident. As soon as we here at __(XYZ Airlines Headquarters)____ gather the details, we will release the information to the media.*"

The person answering the initial call from the media should try not to sound surprised or "thrown-off" by the questions. If they are unable to maintain composure, they should pass the phone call quickly to someone else, after placing the reporter on hold temporarily. It is important that the flight organisation sound and appear on camera as though business is being handled professionally and thoughtfully throughout the entire crisis.

6.4.3 Establish control of media communications by trying to be the best source of information. As soon as possible, provide a means for the public to obtain accurate information, such as a toll-free telephone line and/or a web site that is frequently updates.

6.4.4 Be readily available. Be well prepared. Be accurate. Be co-operative.

6.4.5 Do not talk "off the record".

6.5 CORPORATE ACCIDENT RESPONSE TEAM GUIDELINES: "C.A.R.E."

6.5.1 One method that many corporate aviation departments use to ensure all-important tasks are completed is "***C.A.R.E.***", which stands for "Confirm, Alert, Record, and Employees". The C.A.R.E. method details can be found in Appendix F.

6.6 SMALL ORGANISATION EMERGENCY RESPONSE

6.6.1 This section is intended for small sized or corporate operators that have not yet developed a full-scale crisis management plan. Consultants are available to assist in the development of the plan.

6.6.2 Senior Executive

- Call the next primary or alternate member (the Legal Representative) of your Response Team. Inform him/her of the name and phone number of each Team member notified. **All Senior Executives should be trained to deal with the media.**

- Schedule and hold a press conference as soon as practicable within the first 24 hours after the incident/accident. Show concern for the victims and their families and state only the facts. Do not talk "off the record". **Answer a few questions then delegate a Public Relations representative to address additional inquiries**. Consider reciting other information, such as (if applicable):

  - The corporate aircraft use policy (to enhance corporate productivity)

- Refer reporters an industry organisation and/or the Flight Safety Foundation at (703) 739-6700 regarding corporate aviation safety statistics
- Average number of years of experience for your pilots
- Pilot recurrent training program
- Type and age of aircraft

- Issue an in-house statement for company employees
- Notify the Board of Directors and other executives as necessary

6.6.3 Legal Representative

- Call the next primary or alternate member of your Response Team. Inform him/her of the name and phone number of each Team member notified.
- Co-ordinate with your aviation insurance claims specialist in obtaining statements from the flight crew. Represent crewmembers in discussions with investigation officials.
- Collect information on any third party injuries or property damage.
- Notify the Regulatory and Investigative Agencies. In the case of criminal acts such as sabotage, hostages or a bomb threat, notify the criminal authorities.
- When notifying the Regulatory and Investigative Agencies, simply give the facts. Do not speculate or draw your own conclusions.
- Follow the guidelines of ICAO Annex 13 and NTSB regulation Part 830, or equivalent.

6.6.4 Preservation of Evidence

- Verify that your Team Leader is collecting flight department records.
- Verify with your aviation insurance claims specialist that the wreckage has been preserved.

6.6.5 Aviation Insurance Claims Specialist

- Call the next primary or alternate member (the Human Resources Specialist) of your Response Team. Inform him/her of the name and phone number of each Team member notified.
- Notify your aviation insurance broker and the field claims office nearest to the accident site.
- Review the provisions of your aircraft insurance policy.

6.6.6 Human Resources Specialist

- Call the next primary or alternate member (the Public Relations Representative) of your Response Team. Inform him/her of the name and phone number of each Team member notified.
- Obtain an accurate list of passengers and crewmembers involved from your Team Leader or flight department scheduler. Verify exact names and contact telephone numbers.
- Obtain an accurate report of medical conditions for each individual.
- Arrange to have family members of accident victims notified in person. Use company representatives, local police, Red Cross representatives, etc. for this purpose. Only if

this is impossible, contact family members by telephone. Do not leave a message other than for a return call.

- Be sensitive to immediate needs of family.
  - Consider flying the spouse(s), by airline, to the location of the accident.
  - Offer to pick up children from school or childcare.
  - Offer to inform clergy of each family's choice. Clergy can be helpful as trauma counsellors and assisting with family needs.
- Consider having a professional trauma counsellor available for the families of the victims.
- Co-ordinate group health care coverage with hospitals.
- Photocopy personnel records of flight crew employees for your purposes. Store originals in a secure place for future reference.

6.6.7 Public Relations Representative

- Call your Team Leader. This will confirm that all members of your Team have been contacted. Inform him/her of the name and phone number of each Team member notified.

- Be prepared with a statement for the media. State only the facts. Never speculate as to the possible cause of the incident/accident. Defer determination of probable cause to the investigative authorities.

- The following is an example of a prepared statement:

  "I have received notification that one of our company's aircraft has been involved in an (accident-incident-threatening act). Our sincere concern goes out to all of the families involved. We are in the process of notifying the families of these individuals. I understand that (number) passengers and (number) crewmembers were onboard. "

  "The aircraft was on a flight from (departure point) to (intended destination). This is all we know at this time. We have activated our Emergency Response Plan and are fully co-operating with the investigative authorities in charge to determine exactly what happened. We will inform the media of additional information as soon as it becomes available. Otherwise, we will (hold a press conference-issue a press release) tomorrow at (time)."

- Checklists must be devised for every stage of the procedure. These will form part of the Emergency Procedures manual. Once a plan has been devised a network-wide practice exercise should be accomplished at least once annually to ascertain the effectiveness of the system.
- Personalities and contact details change. Communications and appointment lists should therefore be updated at frequent intervals.

SECTION 6 NOTES

1. Although suitable emergency response procedures can be devised based on the foregoing information, their development is not an easy task. The exact procedures to be adopted will depend on the size of the organisation, its corporate structure, route network, type of operation and the requirements of prevailing legislation not only in the operator's State but also in the country in which the accident occurs. With this in mind it is advisable to enlist the aid of a specialist organisation which can provide training and advice on procedures which are practicable and specific to the operator's needs. See Appendix B for further information on organisations providing such services.

2. <u>US Federal Family Assistance Plan for Aviation Disasters</u>:
The Aviation Disaster Family Assistance Act of 1996 and the Foreign Air Carrier Family Support Act of 1997 stipulate that in the event of an aviation disaster, the NTSB Office of Family Affairs role is to co-ordinate and provide additional resources to the airline and local government to help victims and their families by developing a core group of experienced personnel who have worked aviation accidents while preserving local responsibility jurisdiction. Presently, this legislation applies only to US carriers and those flying to and from the USA, however it may well set a standard for the industry. This is confirmed by the fact that many international operators, some of who do not even fly to the USA, are implementing procedures that are compatible with US legislation.

NTSB Tasks include: Co-ordinate federal assistance and serve as liaison between airline and family members; co-ordinate with airline about family and support staff logistics; integrate federal support staff with airline staff to form *Joint Family Support Operations Centre* (JFSOC); co-ordinate assistance efforts with local and state authorities; conduct daily co-ordination meetings; provide and co-ordinate family briefings; co-ordinate with Investigator-In- Charge for possible visit to crash site; provide informational releases to media on family support issues; maintain contact with family members and provide updates as required.

Airline Tasks include: Provide public with continuous updates on progress of notification; secure a facility to establish a *Family Assistance Centre* (FAC) in which family members can be protected from the media and unwelcome solicitors; make provisions for a *Joint Family Support Operations Centre* to include communication and logistical support; provide contact person to meet family members as they arrive and while at incident site; maintain contact with family members that do not travel to incident site; co-ordinate with American Red Cross to provide mental health services to family members; establish joint liaison with American Red Cross at each supporting medical treatment facility.

Contact Information:

National Transportation Safety Board — Tel: (202) 314-6185
Office of Family Affairs — Fax: (202) 314-6454
490 L'Enfant Plaza East SW
Washington, DC 20594
<u>USA</u>

NTSB 24-Hour Communications Centre (non-public) — Tel: (202) 314-6290

SECTION 7 - RISK MANAGEMENT

7.1 DEFINITIONS

7.1.1 **Risk Management** can be defined as **the identification, analysis and economic elimination, and/or control to an acceptable level, those risks that can threaten the assets or earning capacity of an enterprise**. In this case, a commercial airline. The risk management process seeks to identify, analyse, assess and control the risks incurred in airline operations so that the highest standard of safety can be achieved. It must be accepted that absolute safety is unachievable, but *reasonable* safety can be achieved across the spectrum of the operation. If the flight safety programme outlined in this handbook is adopted and the methods diligently applied, the hazards and risks associated with commercial airline operations can be controlled and minimised. A detailed discussion on the Risk Management Process can be found in Appendix E.

7.1.2 The dictionary defines the word '**risk**' variously as:

- A hazard, danger, chance of loss or injury
- The degree of probability of loss
- A person, object or factor likely to cause loss or danger
- To expose to danger
- To incur the chance of an unfortunate consequence by some action,

and '**hazard**' is defined as:

- A condition that has the potential to cause harm
- To expose to chance

7.2 THE TRUE COST OF RISK

7.2.1 One insurance company has calculated the following (1998 figures):

- Ramp incidents alone cost the industry $3 billion a year, which equates to $300,000 per jet aircraft
- Indirect costs, non-insurable costs, loss of revenue, etc. can exceed the direct costs by 20 times at least.

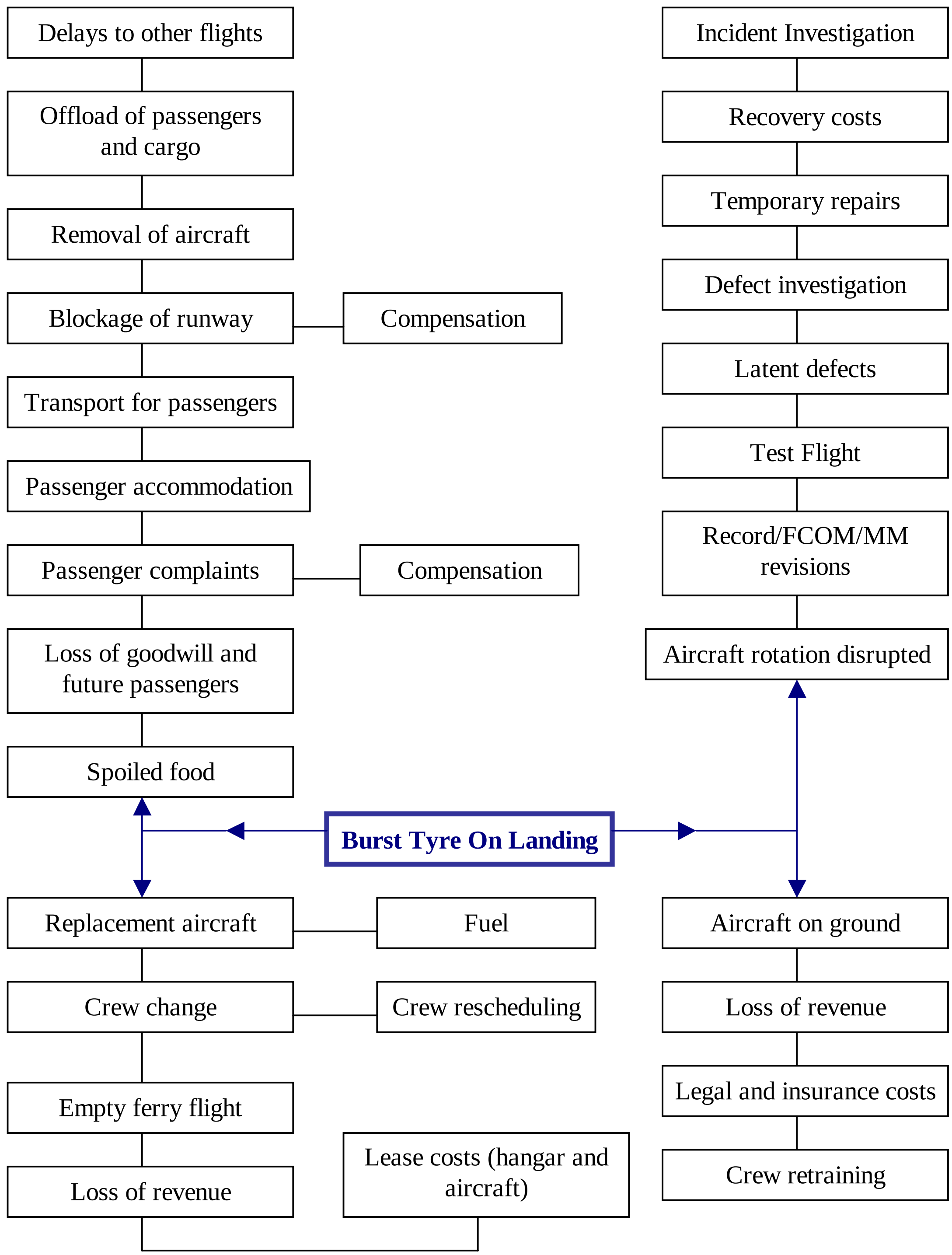
7.2.2 Examples:

Type of Event	Direct costs	Indirect Costs
A/C struck by catering truck	$17,000	$230,000
A/C struck by another whilst taxiing	$1.9 million	$4.9 million
Manoeuvring pier struck parked A/C	$50,000	$600,000
A/C struck by tug during pushback	$250,000	$200,000

Notes: 1. The above examples refer to all-too-common ramp incidents only. It is not generally appreciated that over 1 million vehicle movements a year are required to service one gate, where control and co-ordination is often poor.

2. The direct and indirect costs will increase considerably if the incident occurs at a remote location.

7.2.3 A typical incident and some of its possible consequences:

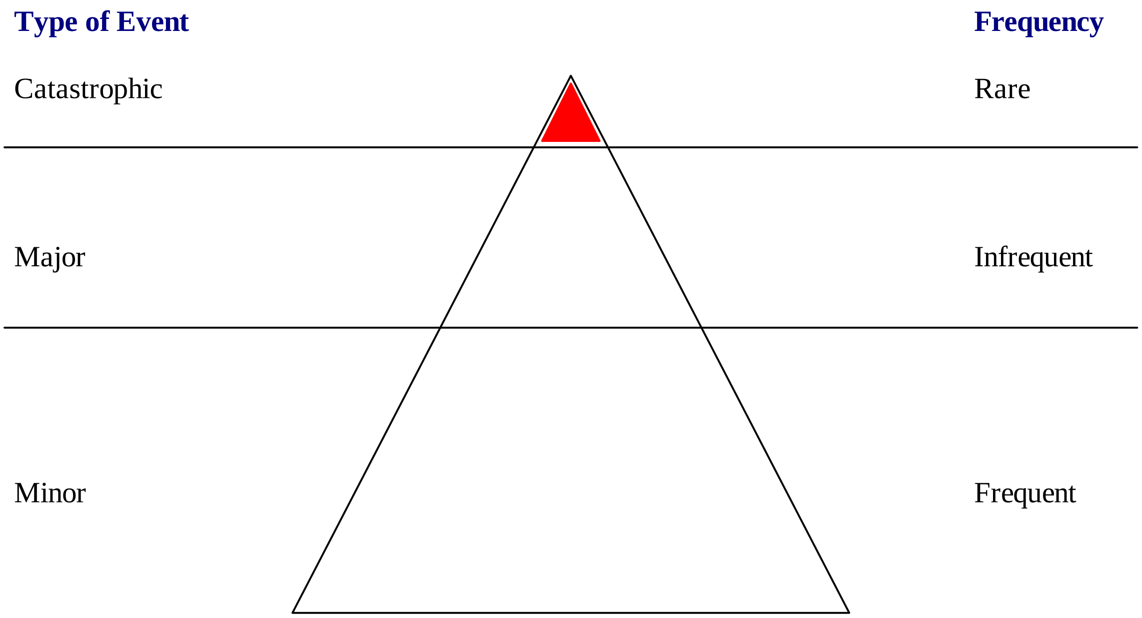


Direct Cost: $20,000

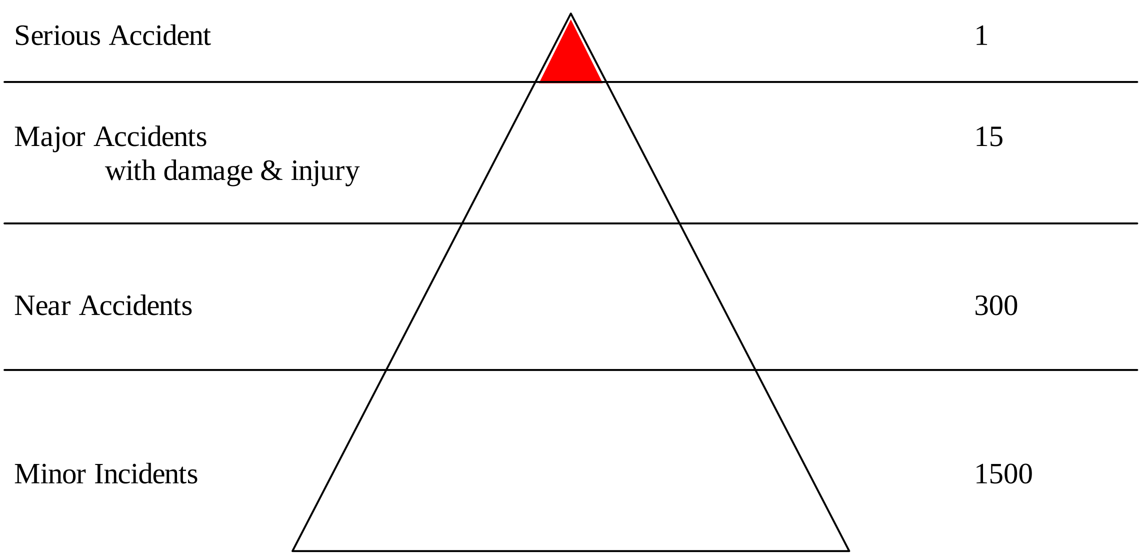
Loss of revenue potential: $1.5 million plus indirect

7.3 RISK PROFILES

73.1 The following profile compares the type of event with the frequency:



7.3.2 Another accident statistics profile* shows:



*Source: NTSB

7.4 SUMMARY

7.4.1 A hazard becomes a risk because of:

- People
- Procedures
- Aircraft and equipment
- Acts of nature

7.4.2 People present the biggest risk for such reasons as:

- Attitude
- Motivation
- Perception
- Ability

7.4.3 A flight safety programme, through its methods of recording and monitoring safety-related occurrences and audit procedures can be considered to be a continuous risk management process. *Assessing* risk, however, is a difficult task and it is best to seek the advice of a specialist Risk Management company. A Risk Management programme will help the airline to improve in areas such as:

- Training and awareness
- Culture and attitudes
- The ability of the operator to carry out self-assessment
- Loss prevention and control
- Auditing procedures

7.4.4 The benefits to the airline are:

- Safer operation
- Cost savings
- Reduced claims
- Establishment of a healthy risk management culture
- An enhanced reputation
- More business

7.5 DECISION MAKING

7.5.1 Operational and technical risks are manageable. Collecting data and appropriate analysis of all data available form a sound basis for the decisions about actions required. It is the Flight Safety Manager's (or his equivalent, i.e. Engineering Manager's) responsibility to ensure proper decisions and that calls for actions are acknowledged and addressed by the department concerned within a specified timeframe. However, it has to be accepted that absolute safety is not achievable, but reasonable safety can be attained across the full spectrum of the operation. Provided, the risk management tools are used respectfully, the risks and hazards associated with commercial airline operations are controlled and minimised. Risk management, however, is incomplete without the consideration of the financial impacts.

7.6 COST/BENEFIT CONSIDERATIONS

7.6.1 Typical common incident cost factors may be:

Operational:	Technical:
Flight Delays	Aircraft Recovery
Flight Cancellations	Aircraft Repair
Runway Obstruction	Test flight
Alternate Passenger Transportation	Incident Investigation
Passenger Accommodation	Technical Documentation
Passenger Complaints	Spare Parts
Catering	Technical Inventory
Loss of Revenue	Aircraft On Ground
Ferry Flight	Lease of Technical Facilities
Crew Change	Repair Team Accommodation
Training/Instruction	Training/Instruction
Loss of reputation	Recertification

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SECTION 8 - ORGANISATIONAL EXTENSIONS

8.1 SAFETY PRACTICES OF CONTRACTORS, SUB-CONTRACTORS, & OTHER THIRD PARTIES

8.1.1 When using sub-contractors the responsibility for quality of the product or service remains with the operator. A written agreement between the operator and the sub-contractor clearly defines the services and quality to be provided. In that written statement, one should define in detail the policies for the sub-contractor officially or contractually. The sub-contractors activities relevant to the agreement should be included in the operator's Quality Assurance Programme. An assessment/audit role is to be taken when addressing the adequacy of the safety practices of outside organisations. Enhancements and/or changes to the outside organisation's safety standards and practices should be suggested prior to the commitment to contractual obligations.

8.1.2 Operators may decide to sub-contract out certain activities to external agencies for the provision of services related to areas such as:

- De/Anti-icing
- Maintenance
- Ground handling
- Flight support (performance calculations, flight planning, navigation database and dispatch)
- Training
- Manual preparation
- Safety audits
- Part suppliers

8.1.3 The operator should ensure that the sub-contractor has the necessary authorisation/approval when required, and commands the resources and competence to undertake the task. If the operator requires the sub-contractor to conduct an activity that exceeds the sub-contractors authorisation/approval, the operator is responsible for ensuring that the sub-contractor's quality assurance takes account of such additional requirements.

8.1.4 If, for example, the operator purchases a performance manual from a sub-contractor the operator remains responsible for the contents and shall undertake the necessary control, including Quality Assurance.

8.1.5 **Quality system training**

8.1.5.1 Effective, well-planned, and resourced quality related training for all of their personnel should be established. Those responsible for managing the Quality System should receive training covering at least the following topics:

- An introduction to the concept of Quality System
- Quality management
- Concept of Quality Assurance
- Quality manuals

- Audit techniques
- Reporting and recording.
- The way in which the Quality System will function in the company.

8.1.5.2 Time should be provided to train every individual involved in quality management and for briefing the remainder of the employees. The allocation of time and resources should be governed by the size and complexity of the operation concerned.

8.1.6 Sources of training

8.1.6.1 Quality management courses are available from the various National or International Standards Instructions or to offer such courses to those likely to be involved in the management of Quality Systems. Operators with sufficient appropriately qualified staff they may decide to carry out in-house training.

8.2 *SAFETY PRACTICES OF PARTNERS*

8.2.1 Liaison with flight safety organisations outside the Company

8.2.1.1 There are many flight safety organisations world-wide. It is up to the individual Flight Safety Officer to become acquainted with them and evaluate their activities in order to obtain the most effective benefits on behalf of the company. Many of the organisations are listed in Appendix B. All have the common aim of pursuing the highest standards of flight safety for public transport operations.

8.2.1.2 By becoming involved with other flight safety organisations and colleagues in other airlines the Flight Safety Officer is able to obtain advice in all aspects of operations for consideration by Flight Operations and Engineering management. Such information can be used to develop, improve or otherwise modify company procedures in the interests of enhancing flight safety.

8.2.1.3 It is important to establish working contacts throughout other airlines and the industry on a global basis. In the event of an accident or incident occurring in a foreign country, lack of local knowledge coupled with wide time zone differences will certainly complicate the start of a company investigation. Consider the immediate concerns, all of which can be addressed initially by the Flight Safety Officer's opposite colleague in a remote area:

- Preservation of DFDR/CVR evidence
- Security of the aircraft
- The welfare of crew and passengers
- Contact with airport, ATC, local and Government authorities
- Assessing the need for operational and engineering assistance
- Provision of facilities to accommodate the Company's investigation team (office space, phone, fax and telex facilities, living quarters on site)

8.2.2 **Aircraft manufacturers** maintain their own flight safety organisations and often promote their activities through regular seminars and conferences. Airbus Industrie, for example, hosts an annual Flight Safety Conference to which all customer Flight Safety Officers and their associates are invited. The conference highlights incidents and accidents that have occurred during the preceding year and provides updates on other events. Customer presentations on any flight safety-related topic are welcomed and a free exchange of information is encouraged. Airbus also operates a confidential information exchange scheme for crews in its customer airlines (AIRS - the Aircrew Incident Reporting System).

8.2.3 **Regulatory and airport authorities** form standing committees whose task is to address flight safety problems in specific regions and airports. The UK CAA's Overseas Working Group and the British Airport Authority's Regional Airport Safety Committee are two such examples. Government- and industry-sponsored initiatives that serve a similar function include US Commercial Aviation Strategy Team (CAST), European Joint Safety Strategy Initiative (JSSI), and the Pan-American Aviation Safety Team (PAST).

8.2.4 **The International Air Transport Association's Safety Committee (IATA SAC)** is an international committee made up of a limited number of elected Flight Safety Managers drawn from the world's airlines. The committee has a balanced membership from the global regions of Africa, Asia-Pacific, Canada, Europe, the Middle East, North America, Oceania and South America. It meets bi-annually in February and July and invites observers from any member airline, aircraft equipment manufacturer, and formal investigation authorities.

8.2.5 The United Kingdom Flight Safety Committee (UKFSC) offers membership through subscription to all European operators of transport aircraft. Affiliated membership is offered to non-European airlines. The UKFSC meets eight times a year.

8.2.6 Other industry associations and organisations include:

- Arab Air Carrier's Organisation (AACO)
- Asia-Pacific Airline Association (APAA)
- Air Transport Association of America (ATA)
- African Aviation Safety Council (AASC, formerly the East, Central and Southern Africa Flight Safety Council [ECASAFI])
- Flight Safety Foundation
- International Association of Latin American Carriers (AITAL)
- International Federation of Airline Pilots Association (IFALPA)

8.2.7 A comprehensive list of addresses and contact details is provided in Appendix B.

8.2.8 <u>Maintaining familiarity with the company's activities</u>

8.2.8.1 The Flight Safety Officer must maintain a constant awareness of developments. Personalities change routinely therefore working relationships with new colleagues must be established. In a successful company new appointments will be created as departments expand; there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure.

8.2.8.2 The procedures set out in this handbook are designed to accommodate such changes, but in order to obtain the best benefits a periodic review of the flight safety programme in relation to the company's development is essential. For example:

- **Code-Sharing Agreements**: Code-sharing is a practice that allows two airlines to use the same flight designator to market a through or single service. *It is highly recommended that a safety audit is conducted of a code-sharing partner which is at least as rigorous as the Company's own internal safety audit. In addition, it is highly recommended that safety information be shared on a regular basis between organisations.* Entry into a code-sharing agreement with another airline often requires the exchange of a token number of cabin crew for assignment for duty on each operator's aircraft as part of the agreement. In this case, the Flight Safety Officer must establish with the other operator an agreed procedure for the reporting, investigation and follow-up of occurrences in which their respective company's crewmembers are involved.

- **Wet-Lease Aircraft Agreements**: It is common practice for an airline to lease another's (the *lessor's*) aircraft and crew to operate some of its services. In some cases the lessor may be operating to a different set of rules and reporting requirements to the host airline (the *lessee*). The lessor needs to be made aware of its obligations in the reporting and follow-up of occurrences whilst operating on behalf of the host company. It is not sufficient for the lessor to report occurrences only to the regulatory authority in its own State of registry. There may be differences in the reporting requirements and culture of the two companies that will need to be resolved. As in code-share agreements the Flight Safety Officer should establish with the other operator an agreed reporting and follow-up procedure to regulate their relationship.

- **Damp-Lease Aircraft Agreements**: Under this arrangement an airline may lease in an aircraft plus flight crew but use its own cabin crew. The procedures above must be applied where appropriate in the interests of all concerned.

APPENDIX A

EXAMPLE FORMS

&

REPORTS

APPENDIX A TABLE OF CONTENTS

AIR SAFETY REPORT	!! THIS BLOCK FOR FLIGHT SAFETY OFFICE USE !! IS THIS EVENT A REPORTABLE OCCURRENCE? YES ☐ NO ☐ REFERENCE No:	XYZ AIRLINES

1. TYPE OF EVENT (CHECK ALL THAT APPLY) — **ASR** ☐ **AIRPROX/ATC** ☐ **TCAS RA** ☐ **WAKE TURBULENCE** ☐ **BIRD STRIKE** ☐

2. CM1	**CM2**	**CM3**

3. DATE OF OCCURRENCE **DD MM YR**	**4. TIME LOCAL / UTC** **DAY / NIGHT**	**5. SERVICE NR./CALLSIGN**	**6. ROUTE FROM / ROUTE TO**

7. DIVERTED TO	**8. AIRCRAFT TYPE**	**9. REGISTRATION**	**10. NR. OF PASSENGERS / CREW**	**11. TECH LOG REFERENCE NR.**

12. FLIGHT PHASE: TOWING - PARKED - PUSHBACK - TAXY OUT - TAKE-OFF - INITIAL CLIMB
CLIMB - CRUISE - DESCENT - HOLDING - APPROACH - LANDING - TAXY-IN

13. ALTITUDE
FL .... FT ....

14. SPEED **MACH NR.**	**15.FUEL DUMPED:** QUANTITY TIME LOCATION	**16. MET CONDITIONS:** IMC VMC km

17. WX ACTUAL: WIND VISIBILITY CLOUD TEMP (ºC) QNH (mb)

18. SIGNIFICANT WX: **MODERATE/SEVERE:** RAIN - SNOW - ICING - FOG - TURBULENCE - HAIL - STANDING WATER - WINDSHEAR

19. RUNWAY: L / C / R	**20. RUNWAY STATE**: RVR: DRY - WET - ICE - SNOW - SLUSH - DEBRIS

21. AIRCRAFT CONFIGURATION: AUTOPILOT AUTOTHRUST GEAR FLAP SLAT SPOILER

22. EVENT SUMMARY (CONCISE DESCRIPTION OF EVENT)

23. ACTION TAKEN, RESULT AND ANY SUBSEQUENT EVENT(S)

24. OTHER INFORMATION AND SUGGESTIONS FOR PREVENTIVE ACTION

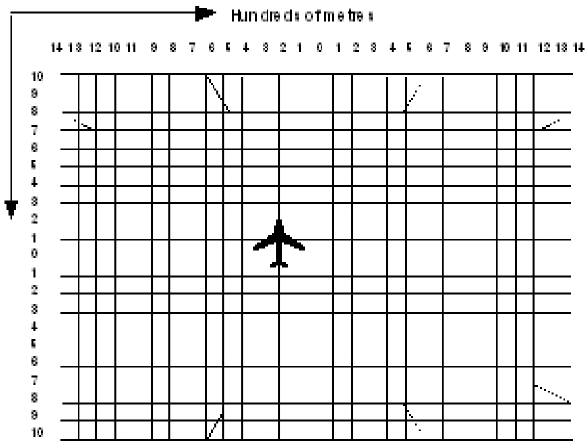
!! PLEASE COMPLETE APPLICABLE SECTIONS OVERLEAF !!

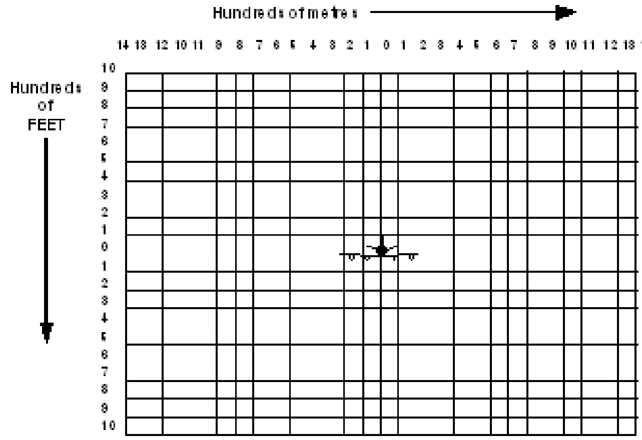
25. MAINTENANCE ENGINEER'S BRIEF REPORT

AIRPROX - ATC INCIDENT - TCAS RA - WAKE TURBULENCE - BIRD STRIKE
COMPLETE ASR SECTIONS 1 TO 25 AND ADD RELEVANT DETAILS FOR SPECIFIC EVENT BELOW (26, 27 OR 28)

26. AIRPROX/ATC INCIDENT and/or TCAS

Mark the passage of the other aircraft relevant to you, in plan on the left and in elevation on the right, assuming YOU are at the centre of each diagram





VIEW FROM ABOVE (horizontal plane: metres [ ] or n.m. [ ])

VIEW FROM ASTERN (vertical plane: feet)

1. SEVERITY OF RISK LOW / MED / HIGH
2. AVOIDING ACTION TAKEN? YES / NO
3. REPORTED TO ATC .... UNIT
4. ATC INSTRUCTIONS ISSUED? ....
5. YOUR CALL SIGN ....
6. FREQUENCY IN USE ....
7. HEADING .... DEG
8. VERTICAL DISTANCE FROM CLOUD .... FT
9. HORIZONTAL DISTANCE FROM CLOUD .... KM
10. MINIMUM VERTICAL SEPARATION .... FT
11. MINIMUM HORIZONTAL SEPARATION .... M/n.m.
12. SQUAWK C
13. TCAS ALERT RA / TA / NONE
14. RA FOLLOWED? YES / NO VERT DEVIATION.......... FT
15. OTHER AIRCRAFT: TYPE ....
MARKINGS/COLOUR ....
CALLSIGN/REGISTRATION ....
LIGHTING ....

27. WAKE TURBULENCE

1. HEADING ....
2. TURNING? LEFT / RIGHT / NO
3. POSITION ON GLIDESLOPE HIGH / LOW / ON
4. POSITION ON EXTENDED CENTRELINE LEFT / RIGHT / ON
5. CHANGE IN ATTITUDE PITCH....... ROLL........ YAW .... DEG......
6. CHANGE IN ALTITUDE .... FT
7. WAS THERE BUFFET? YES / NO STICK SHAKE? YES / NO
8. WHAT MADE YOU SUSPECT WAKE TURBULENCE?
9. DESCRIBE ANY VERTICAL ACCELERATION
10. GIVE DETAILS OF PRECEDING AIRCRAFT (TYPE/CALL SIGN)
11. WERE YOU AWARE OF THE OTHER A/C BEFORE THE INCIDENT?

28. BIRD STRIKE

1. LOCATION ....
2. TYPE OF BIRDS ....
3. NR. SEEN 1 [ ] 2-10 [ ] 11-100 [ ] MORE [ ]
4. NR. STRUCK 1 [ ] 2-10 [ ] 11-100 [ ] MORE [ ]
5. TIME DAWN [ ] DAY [ ] DUSK [ ] NIGHT [ ]

DESCRIBE IMPACT POINT AND DAMAGE OVERLEAF

NAME OF REPORTER ....

RANK .... **DATE** ....

SIGNATURE ....

DISPOSAL INSTRUCTIONS

FAX COMPLETED FORM AS SOON AS POSSIBLE TO FLIGHT OPERATIONS CONTROL THEN RETURN ORIGINAL VIA COMPANY MAIL SYSTEM TO THE FLIGHT SAFETY MANAGER

XYZ AIRLINES	AIR SAFETY REPORT	FOR OFFICE USE ONLY: Number:............................ Date Received:..................

1. Type of Occurrence	Airmiss	Birdstrike	Wake Turbulence	Technical	PED Interference	Other
	☐	☐	☐	☐	☐	----------------

2. Aircraft Type	3. Engines Type	4. Registration	5. Crew: Capt.	F/O	Other Crew
________	________	________	________	________	________

6. Flight No.	7. From / To	8. Date	9. Time	10. Landing at/or
________	____/____	________	____UTC/____ LT	Destination/________

11. Flight Phase	Parked	Push back	Taxi	Takeoff	Climb	Cruise	Descent	Holding	Approach	Landing
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

12. Flight info.	Altitude	Speed	Flaps	Slats	Thrust EPR/N1	Gear Up/Down	A/pilot No ☐ Yes/n°	A/thrust No/ Yes	Spoilers No / Yes	Etops No/Yes
	------FT	-----kts	----°	-----	-----/----	☐ / ☐	☐ /----	☐ ☐	☐ ☐	☐ ☐

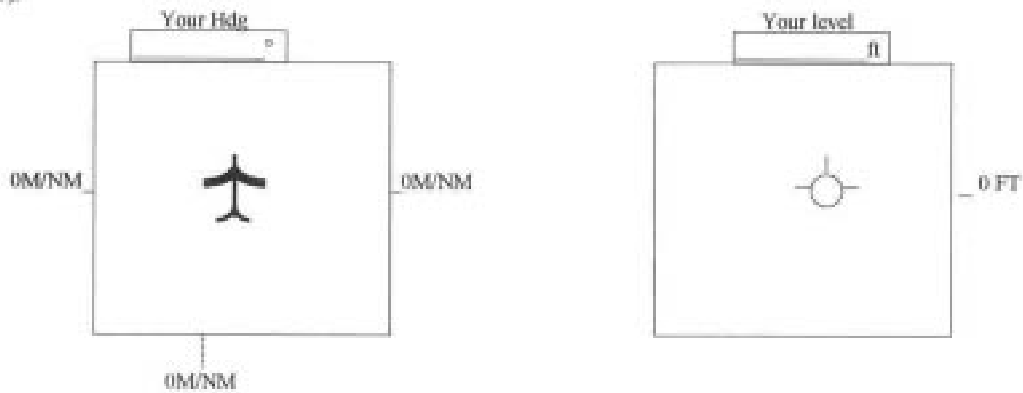
13. Weather Info.	IMC/VMC	Wind	Visibility	Clouds No <4/8 >4/8	TEMP	QNH	PRECIPITATION Fg Dz Rn Sn Nil
	☐ / ☐	----°/----kts	---------M	☐ ☐ ☐	------°C	-------hp	☐ ☐ ☐ ☐ ☐

14. General Info.	A/C Weight	Crew/Pax	Tech.Log Ref Sheet/Item	Dr's Kit used No / Yes	Restraint Kit used No / Yes	Fuel Jettison No/Yes	Injuries Nil / N°
	----------kgs	----/------	-----/------	☐ ☐	☐ ☐	☐/........ kg	☐ / ......

15. Captain's Remarks:

OPS.FORM No. 03 NOV.98

16. AIRMISS: Plot position of other aircraft relative to you assuming you are at the centre of the rectangle at time of passage & write estimated minimum horizontal separation in Meters (M) or Nautical Miles (NM) and estimated minimum vertical separation in feet (FT).



Avoiding action	By whom	TCAS ALERT	Useful	TA / RA	Under Radar	ATC INST ISSUED	FREQ	126.9	Reptd to ATC by
Yes / No	You / Him	Yes / No	Yes / No		Yes / No	Yes / No		You / Him	You/Him
☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	-------	☐ ☐	☐ ☐

Risk Assessment:	High	Med	Low	None	Other Aircraft:	Type	Colour	Lights	Call sign	Strobe lights
	☐	☐	☐	☐		_____	_____	ON/OFF	_____	ON/OFF

17. Bird Strike	Size of Bird:	No. of Birds:	1	2-10	11-100	More	Parts of aircraft:	Radome	Windshield	Nose	Eng	Wing	Gear	Others
Bird	☐ Small													
Species	☐ Medium	Seen	☐	☐	☐	☐	Struck	☐	☐	☐	☐	☐	☐	☐
______	☐ Large	Struck	☐	☐	☐	☐	Damaged	☐	☐	☐	☐	☐	☐	☐

18. Wake Turbulence	Turning	Buffet	Stick Shaker	Change in Attitude	Change in Altitude	Alerted by
Position	Yes / No	Yes / No	Yes / No	Pitch Roll Yaw		ATC Traffic Not
________	☐ ☐	☐ ☐	☐ ☐	☐ ☐ ☐	--------------- ft	☐ ☐ ☐

19. Technical Hydraulic ☐ Electric ☐ Mechanic ☐ Instrument ☐ Airframe ☐ Engine No...............

Snag____

____

____

____

20. PED ➡ Interference	PED Type	Manufacturer	Model	Seat Location	User Name	Address	Tel.	Action by Crew
						______	______	Yes / No
						______	______	☐ ☐
	______	______	______	______	______	______	______	

Capt's Name:______________	Signature:______________	Date:______________

FILL AND RETURN TO THE OFFICE OF HEAD OF SAFETY IMMEDIATELY AFTER LANDING

CONFIDENTIAL REPORTING SCHEME

XYZ AIRLINES

MAY WE CONTACT YOU? If so, please provide your name and contact number:

Name ……………………………………………………………………… Tel ………………………

1. DATE OF OCCURRENCE DD MM YR	2. TIME LOCAL / UTC DAY / NIGHT	3. SERVICE NR./CALLSIGN	4. AIRCRAFT REGISTRATION

THE ABOVE INFORMATION IS CONFIDENTIAL. IT WILL BE REMOVED FROM THE REPORTING FORM AND RETURNED TO YOU NO RECORD OF YOUR IDENTITY WILL BE KEPT

✂ ………

5. A/C TYPE	6. ROUTE: FROM TO DIVERTED TO	7. NR. OF PASSENGERS/CREW	8. ETOPS?
9. ALTITUDE FL ……………. FT ……………..	10. NEAREST AIRPORT, NAVAID OR FIX		11. ASR RAISED?
12. TECH LOG REF: SECTOR	LOG REF ITEM No.	13. MET: IMC VMC	

14. SIGNIFICANT WX: MODERATE/SEVERE RAIN - SNOW - ICING - FOG - TURB - HAIL - STANDING WATER - WINDSHEAR

15. AIRCRAFT CONFIGURATION: AUTOPILOT AUTOTHRUST GEAR FLAP SLAT SPOILER

16. FLIGHT PHASE: TOWING - PARKED - PUSHBACK - TAXY OUT - TAKE-OFF - INITIAL CLIMB (below 1500 ft.) - CLIMB - CRUISE - DESCENT - HOLDING - APPROACH (below 1500 ft.) - LANDING - TAXY-IN

17. REPORTER:

- CAPTAIN ☐
- F/O ☐
- OTHER CREW MEMBER ☐
- PILOT FLYING ☐
- PILOT NOT FLYING ☐

18. FLYING TIME:

- TOTAL ………………………………… HRS
- LAST 90 DAYS …………………….. HRS
- TIME ON TYPE ……………………. HRS

WHAT HAPPENED? (Briefly describe the event, along with any contributing factors e.g. weather, technical problems, SOPs, airfield facilities).

Please do not write in this space

WHY DID IT HAPPEN? (Describe the failure(s) that allowed the incident to happen e.g. technical, training inadequacy, regulations, crew co-ordination).

HOW WAS IT FIXED? (Describe the steps you took, from diagnosing the problem to recovery of the

SAFETY RECOMMENDATIONS: (Tell us what can be done [and by whom] to improve the safety response to a similar event. Within airline [e.g. training, standards, cabin, maintenance] or outside the airline [regulator, manufacturer, other

4) APPLY GLU HERE, FOLD AND AFFIX

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

XYZ AIRLINES

SAFETY DEPARTMENT

CONFIDENTIAL REPORTING FORM

Event Date	Flight number	Name
Aircraft type	Registration	Flight phase

Should you desire to receive a personal reply or should we need more information to clarify the event, kindly specify the way you prefer us to contact you :

Telephone #................................E-mail :..Mailbox #.......................Other........

1. Briefly describe the event, along with any relevant external factors such as weather, ATC or airfield facilities.

2. How were you feeling and how were you getting on as a crew ?

3. How did you and the crew respond to the event ?

4. How did you establish what technical/operational and personal/crew issues were involved?

5. Did the drills and procedures work well in solving the problem and was all the technical information you required familiar and easily available ? If not, please specify what could be improved.

6. How well did your training (technical/non-technical) prepare you for this situation? What training was particularly good and what could be improved?

3) FOLD INSIDE

CONFIDENTIAL

TO : XYZ AIRLINES SAFETY DEPT.
ADDRESS

2) FOLD INSIDE

INTENTIONALLY LEFT BLANK

1) FOLD INSIDE

7. What is in your opinion the most important lesson from this event ?
8. Any other comments to improve the safety response for a similar event ?

Confidential Aviation Incident Report

BASI

This form may be used instead of the yellow Air Safety Accident or Incident Report form to report a serious incident, an incident or a safety deficiency if the reporter requires confidentiality.

The Bureau of Air Safety Investigation collects information for the purposes of enhancing aviation safety. The information is collected under the authority of sections 19BA and 19BC of Part 2A of the Air Navigation Act 1920.

When you have completed the report, please forward it to CAIR by one of the methods detailed over the page. This report will be returned to you on completion of the investigation.

Date

Local time

Location (e.g. 27 NM west of Bowral, NSW)

Aircraft registration

Aircraft make/model

Your position (eg pilot, ATS, LAME, FA)

Pilot. Your total hours

Non-pilot experience yr/mth

Aircraft operator

Aircraft owner

Aircraft hirer (if any)

Type of operation:

- Air transport – passenger
- Flying training – solo
- Business
- Gliding
- Air transport – cargo
- Flying training – dual
- Agricultural
- Sports aviation
- Charter
- Private
- Military
- Other

Flight rules: VFR IFR

Flight conditions: VMC IMC

Persons on board:

Crew Passengers

Last departure point of flight

Time of departure Local

First point of intended landing

Please indicate the phase in which the occurrence happened:

- Aircraft standing
- Taxiing
- Takeoff
- En route
- Manoeuvring
- Approach
- Landing

Airspace designation

Please fully describe the incident. All relevant documents may be forwarded to CAIR using the methods detailed over this page. Please include suggestions as to how this type of occurrence could be prevented in the future.

Additional space available overleaf

POSTAGE
PAID
AUSTRALIA

Reply Paid 22
The Manager
PO Box 600
Civic Square ACT 2608

No stamp is required if this form and any other material is mailed. If using facsimile, do not forget to send both sides of this form

Office contact details are:

Phone:	1800 020505
Facsimile:	(02) 6274 6461
Internet email:	cair@atsb.gov.au

Continued from front of form

Please enclose additional page/s if necessary

The Director of the Bureau of Air Safety Investigation guarantees to keep your identity confidential. Your personal details will not be recorded and this entire report will be returned to you.
To enable us to contact you for clarification of details, to discuss what actions to take on the report and to determine how best to de-identify your report, please fill in all the spaces in this section.

NO ACTION IS TAKEN ON ANONYMOUS REPORTS
Do not include contact details (such as a work phone number) that you do not wish us to call you on and please indicate if we are not to leave a message on an answering machine. Include the best time for phone contact and your address so we can return this form to you.

Your name

Address

Telephone **Facsimile** **Internet email**

If mailing, please fold and post. No stamp is required.

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TELEPHONE NUMBERS where we may reach you for further details of this occurrence:

HOME Area ______ No. ________ - __________ Hours _____

WORK Area ______ No. ________ - __________ Hours _____

NAME ____________________

ADDRESS/PO BOX ____________________

____

CITY ____________ **STATE** ____ **ZIP** ________

TYPE OF EVENT/SITUATION ____________

____

DATE OF OCCURRENCE ____________

LOCAL TIME (24 hr. clock) ____________

DO NOT REPORT AIRCRAFT ACCIDENTS AND CRIMINAL ACTIVITIES ON THIS FORM.
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ALL IDENTITIES CONTAINED IN THIS REPORT WILL BE REMOVED TO ASSURE COMPLETE REPORTER ANONYMITY.

FIRST FOLD

FIRST FOLD

PLEASE FILL IN APPROPRIATE SPACES AND CHECK ALL ITEMS WHICH APPLY TO THIS EVENT OR SITUATION.

REPORTER	FLYING TIME	CERTIFICATES/RATINGS		ATC EXPERIENCE	
○ Captain	total ________ hrs.	○ student	○ private	○ FPL	○ Developmental
○ First Officer		○ commercial	○ ATP	radar ________ yrs.	
○ pilot flying	last 90 days ______ hrs.	○ instrument	○ CFI	non-radar ________ yrs.	
○ pilot not flying		○ multiengine	○ F/E	supervisory ________ yrs.	
○ Other Crewmember	time in type ______ hrs.	○ ____________		military ________ yrs.	
○ ____________					

AIRSPACE		WEATHER		LIGHT/VISIBILITY		ATC/ADVISORY SERV.	
○ Class A (PCA)	○ Special Use Airspace	○ VMC	○ ice	○ daylight	○ night	○ local	○ center
○ Class B (TCA)	○ airway/route ______	○ IMC	○ snow	○ dawn	○ dusk	○ ground	○ FSS
○ Class C (ARSA)	○ unknown/other ______	○ mixed	○ turbulence	ceiling ______ feet		○ apch	○ UNICOM
○ Class D (Control Zone/ATA)	____________	○ marginal	○ tstorm	visibility ______ miles		○ dep	○ CTAF
○ Class E (General Controlled)	____________	○ rain	○ windshear	RVR ______ feet		Name of ATC Facility:	
○ Class G (Uncontrolled)	____________	○ fog	○ ______			____________	

	AIRCRAFT 1			AIRCRAFT 2		
Type of Aircraft (Make/Model)	(Your Aircraft) ____________		○ EFIS ○ FMS/FMC	(Other Aircraft) ____________		○ EFIS ○ FMS/FMC
Operator	○ air carrier ○ commuter	○ military ○ private	○ corporate ○ other ______	○ air carrier ○ commuter	○ military ○ private	○ corporate ○ other ______
Mission	○ passenger ○ cargo	○ training ○ pleasure	○ business ○ unk/other ______	○ passenger ○ cargo	○ training ○ pleasure	○ business ○ unk/other ______
Flight plan	○ VFR ○ IFR	○ SVFR ○ DVFR	○ none ○ unknown	○ VFR ○ IFR	○ SVFR ○ DVFR	○ none ○ unknown
Flight phases at time of occurrence	○ taxi ○ takeoff ○ climb	○ cruise ○ descent ○ approach	○ landing ○ missed apch/GAR ○ other ______	○ taxi ○ takeoff ○ climb	○ cruise ○ descent ○ approach	○ landing ○ missed apch/GAR ○ other ______
Control status	○ visual apch ○ controlled ○ no radio	○ on vector ○ none ○ radar advisories	○ on SID/STAR ○ unknown	○ visual apch ○ controlled ○ no radio	○ on vector ○ none ○ radar advisories	○ on SID/STAR ○ unknown

If more than two aircraft were involved, please describe the additional aircraft in the "Describe Event/Situation" section.

LOCATION		CONFLICTS			
Altitude ____________	○ MSL ○ AGL	Estimated miss distance in feet: horiz ______ vert ______			
Distance and radial from airport, NAVAID, or other fix ____________		Was evasive action taken?		○ Yes	○ No
____________		Was TCAS a factor?	○ TA	○ RA	○ No
Nearest City/State ____________		Did GPWS activate?		○ Yes	○ No

DESCRIBE EVENT/SITUATION

Keeping in mind the topics shown below, discuss those which you feel are relevant and anything else you think is important. Include what you believe really caused the problem, and what can be done to prevent a recurrence, or correct the situation. (CONTINUE ON THE OTHER SIDE AND USE ADDITIONAL PAPER IF NEEDED)

CHAIN OF EVENTS	HUMAN PERFORMANCE CONSIDERATIONS
- How the problem arose - How it was discovered - Contributing factors - Corrective actions	- Perceptions, judgments, decisions - Actions or inactions - Factors affecting the quality of human performance

NASA ARC 277B (January 1994)

*U.S. Government Printing Office: 1997-585-485/79199

National Aeronautics and
Space Administration

Ames Research Center
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Moffett Field, CA 94035-1000

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PO BOX 189
MOFFETT FIELD CA 94035-9800

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NASA has established an Aviation Safety Reporting System (ASRS) to identify issues in the aviation system which need to be addressed. The program of which this system is a part is described in detail in FAA Advisory Circular 00-46D. Your assistance in informing us about such issues is essential to the success of the program. Please fill out this postage free form as completely as possible, fold it and send it directly to us.

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Thank you for your contribution to aviation safety.

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DESCRIBE EVENT/SITUATION (continued):

SECOND FOLD

SECOND FOLD

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(SPACE BELOW RESERVED FOR ASRS DATE/TIME STAMP)

TELEPHONE NUMBERS where we may reach you for further details of this occurrence:

HOME Area ______ No. ________ - _________ Hours _____

ALTERNATE Area ______ No. ________ - _________ Hours _____

NAME ____________________

ADDRESS/PO BOX ____________________

CITY __________ **STATE** ____ **ZIP** ______

TYPE OF EVENT/SITUATION ____________________

DATE OF OCCURRENCE ____________

LOCAL TIME (24 hr. clock) ____________

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PLEASE FILL IN APPROPRIATE SPACES AND CHECK ALL ITEMS WHICH APPLY TO THIS EVENT OR SITUATION

REPORTER		EXPERIENCE	
○ Flight Attendant (FA)	○ Trainee	Total years as Flight Attendant	________
○ FA in charge	○ Off-Duty FA	Total years as FA with your current airline	________
○ Extra FA		Number of aircraft types currently qualified to work on	________
○ Other ________		Percent of duty time in past year on aircraft type involved	________

FLIGHT INFORMATION

Type of aircraft (Make/Model) ____________________
number of seats ______ number of pax on board ______ number in cabin crew ______
number of exits: floor level ______ window ______ tailcone ______

Flight segment flight origin ________ destination ________ departure time ______
time since takeoff ______ hrs/mins nearest city/state (if known) ________

Cabin activity (check all that apply)
○ boarding ○ beverage service ○ cart service ○ movie
○ deplaning ○ meal service ○ tray service ○ other ______
○ safety related duties, specify ____________________

OPERATOR	FLIGHT PHASE		WEATHER		LIGHTING CABIN	LIGHTING OUTSIDE
○ air carrier	○ predeparture	○ descent	○ clear	○ cloudy	○ bright	○ daylight
○ commuter	○ taxi	○ approach	○ rain	○ fog	○ medium	○ night
○ corporate	○ takeoff	○ landing	○ turbulence	○ snow	○ dark	
○ charter	○ climb	○ gate arrival	○ thunderstorms	○ ice		
○ other ______	○ cruise	○ other ______	○ unknown			

EVENT CHARACTERISTICS

Reporter's location in aircraft at time of event: ____________________

Reporter's activity at time of event ____________________

Was a passenger directly involved in the event? ○ Yes ○ No

Did this event result in an injury? ○ Yes ○ No
to passenger? ○ Yes ○ No
to crew? ○ Yes ○ No

Was fire/smoke involved in the event? ○ Yes ○ No

Was there an evacuation during or as a result of this event? ○ Yes ○ No

DESCRIBE EVENT/SITUATION

Keeping in mind the topics shown below, discuss those which you feel are relevant and anything else you think is important. Include what you believe really caused the problem, and what can be done to prevent a recurrence, or correct the situation. (CONTINUE ON THE OTHER SIDE AND USE ADDITIONAL PAPER IF NEEDED)

FIRST FOLD

FIRST FOLD

CHAIN OF EVENTS	HUMAN PERFORMANCE CONSIDERATIONS
- How the problem arose - How it was discovered	- Perceptions, judgments, decisions - Actions or inactions
- Contributing factors - Corrective actions	- Factors affecting the quality of human performance

NASA ARC 277C (June 1995)

CABIN CREW

Rev Date: 06/29/95

National Aeronautics and
Space Administration

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DESCRIBE EVENT/SITUATION (continued):

SECOND FOLD

SECOND FOLD

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HOME Area ______ No. ________ - __________ Hours ______

WORK Area ______ No. ________ - __________ Hours ______

NAME ____

ADDRESS/PO BOX ________________________________

____

CITY ____________________ **STATE** ____ **ZIP** __________

TYPE OF EVENT/SITUATION ______________

____

DATE OF OCCURRENCE ______________

LOCAL TIME (24 hr. clock) ______________

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PLEASE FILL IN APPROPRIATE SPACES AND CHECK ALL ITEMS WHICH APPLY TO THIS EVENT OR SITUATION

FIRST FOLD

EXPERIENCE

Describe your qualifications	○ A & P ○ A ○ P ○ repairman ○ inspection authority ○ FCC other ________
What is your technician/maintenance experience in years?	lead technician ________ technician ________ repairman ________ avionics ________ other ________

FACTORS

Location ____

Was training a factor?	○ yes	○ no	○ I was instructing	○ I was receiving training
What other factors may have contributed?	○ lighting ○ weather	○ work cards ○ manuals	○ briefing ○ other______	

Check items which were involved in the event

inspection	○ yes	○ no	installation	○ yes	○ no
testing	○ yes	○ no	scheduled maintenance	○ yes	○ no
repair	○ yes	○ no	MEL	○ yes	○ no
logbook entry	○ yes	○ no	* other	________	
fault isolation	○ yes	○ No	*(*Describe in the "Describe Event/Situation" sector)*		

Component/System/Subsystem involved: ________________________________

Was maintenance deferred? ○ yes ○ no

When was problem detected? ○ routine inspection ○ in-flight ○ taxi ○ while aircraft was in service at gate ○ pre-flight ○ other______

CONSEQUENCES/OUTCOME

○ flight delay ○ flight cancellation	○ gate return ○ in-flight shut down	○ aircraft damage ○ rework	○ improper service ○ air turn back ○ other______

AIRCRAFT/AIRWORTHINESS STATUS	MISSION	OPERATOR (Check all that apply)	
○ aircraft released for service	○ passenger	○ air carrier	○ government
○ aircraft records completed	○ cargo	○ commuter	○ military
○ aircraft required documents aboard	○ business	○ corporate	○ part 121
○ not released for service	○ training	○ air-taxi	○ part 135
○ unknown	○ pleasure	○ charter	○ repair station
	○ other______	○ FBO	○ self employed
		○ flight school	○ other______

TYPE OF AIRCRAFT (MAKE/MODEL) AND ENGINE TYPE

type of aircraft ____________	series ____________	ATA Code ____________
aircraft zone ____________	engine model ____________	other ____________

DESCRIBE EVENT/SITUATION

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NASA ARC #277D **MAINTENANCE** Rev Date: 08/1/96

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DESCRIBE EVENT/SITUATION (continued):

SECOND FOLD

SECOND FOLD

A340

XYZ AIRWAYS
FLIGHT CREW NOTICE

A340

FLEET NOTICE: No. 99/99

APPLICABILITY: All A340 Pilots

Airbus Industrie has issued a Flight Operations Telex in connection with the following:

Subject: A330/A340 - ATA 22 - CONFLICTING FD INDICATIONS DURING TAKE-OFF

Two operators have reported that after take-off the crew noticed two different lateral commands from the left and right roll FD bars. Five different events have occurred: two on the same aircraft and for the same departure (RWY 09R/BPK 5J SID), two others on RWY 09R/BUZAD 3J with two different aircraft. One event occurred on departure from Athens.

The initial investigation shows that the events were due to a non- or late sequencing of the 'TO' waypoints by one FMS. In all the SIDS concerned there is a left turn after take-off. If the Flight Plan is correctly flown by the A/P (or by the crew) the aircraft will turn to the left. If the opposite FMS has not sequenced the waypoint (i.e. the left turn transition) it will continue to generate FD commands to continue the previous leg straight ahead and will thus command a right lateral FD order.

The above scenario is only a hypothesis but it can easily be confirmed by comparing the 'TO' waypoint displayed in the upper right corner of both navigation displays (ND) during the time the FD commands conflict.

Recommendations:

1. During pre-flight, review the SID and the associated turn direction. Once airborne, monitor the 'TO' waypoint on the ND. If the A/P F/D does not follow the intended flight path, select HDG on the FCU to track it.

2. If the same abnormality is encountered, make an appropriate tech log entry at the end of the flight.

3. Airbus would like a copy of the DFDR, a printout of the FM flight reports (from both FM) and a comprehensive crew report specifying the 'TO' waypoint identifier displayed on each ND and on each MCDU at the time of the occurrence.

APPROVED BY: ______________________ OPS ENGINEERING MANAGER

SIGNED: ___________________________

ISSUING AUTHORITY: _________________ HEAD OF FLIGHT CREW

SIGNED: ___________________________

DATE ISSUED: ______________________ REMOVAL DATE: __________________

XYZ AIRLINES

CONFIDENTIAL

REPORT CONCERNING AN INCIDENT INVOLVING [A/C TYPE] [REGN]
AT .... ON ....

INVESTIGATING BOARD:	(Member 1) (Member 2) (Member 3)
IN ATTENDANCE:	(CM 1) (CM 2) (CM 3)

CONTENTS:

[DISTRIBUTION LIST]
1
2
3
4
5
6
7
8

LOADING STATION	**NOTIFICATION TO CAPTAIN**	**XYZ AIRLINES**

Flight No.	Aircraft Reg'n	Date	Prepared by: (Signature)

DANGEROUS GOODS (COMPATIBILITY GROUP MUST BE SHOWN IN CLASS COLUMN)

Stn of Unload ing	Air Waybill No. (last 4 digits)	No. of Pkgs	UN Number	Proper Shipping Name of Article	Class or Division	Subs-idiary Risk	Net Qty or Transport Index per Package	Packing Group	Code (see below)	Loaded ULD or Position

ADDITIONAL INFORMATION

OTHER SPECIAL LOAD

Stn of Unloading	Air Waybill No. (last 4 digits)	No. of Pkgs	Description	Code (see below)	Loaded ULD or Position

CODE	Description
REX	Explosives
R	Explosives Category 1
RNG	Non-flam. compressed gas
RPG	Poisonous Gases
RFL	Flammable Liquids
RFS	Flammable Solids
RSC	Spontaneously Combustible
RFW	Dangerous When Wet
ROX	Oxidising Substances
ROP	Organic Peroxide
RPS	Poisonous Substances
RHF	Harmful
RIS	Infectious Substances
RRW	Radioactive Category 1
RRY	Radioactive Cat. 2/3
RCM	Corrosives
RMD	Misc. Dangerous Goods

I CONFIRM THAT THE ARTICLES LISTED ABOVE WERE LOADED AS SHOWN AND THAT THERE WAS NO EVIDENCE OF DAMAGED OR LEAKING

CAPTAIN'S SIGNATURE . . . .

OTHER SPECIAL LOADS

CODE	DESCRIPTION
AVI	Live Animals
CAO	Cargo Aircraft Only
HEA	Heavy Cargo
HUM	Human Remains
ICE	Dry Ice
PER	Perishable Cargo
VAL	Valuable Cargo

DISTRIBUTION: Original - Loading Station Pink - Captain Blue - Dispatch Yellow - Unloading Station

Existing Condition

Recommended Corrective Action

Please detail the existing condition and any recommended corrective action. Use additional sheets as necessary. Drop in any Safety Suggestion box or mail to the Flight Safety Office. If you would like an update on any action please provide your name and phone or address. Thank you for your interest in the Flight Safety Program.

Date: ______ Organisation: ________________ Name. (Optional) ____________________

Location: ______________________________

Flight Safety Only

Rcvd: ______	No: _______	Assigned to: ____________________

APPENDIX B

REFERENCE MATERIAL

&

SOURCES OF INFORMATION

APPENDIX B TABLE OF CONTENTS

TELEPHONE ENQUIRY CENTERS

Name of Centre	Location	Operated by	Contact Details
EPIC	London (LHR)	British Airways	Tel: +44 181 513 0919 Fax: +44 181 513 0922
GAST	Munich	Munich Police Force	Tel: +49 89 979 1000 Fax: +49 77 293 4258
CRIC	Paris ORY & CDG	Airline Operator's Committees	
Prestige	Japan	Prestige International	
SAA EPIC	Johannesburg	South African Airways	Tel: +27 11 978 5710 Fax: +27 11 978 5564
REACT	Sydney	QANTAS	Tel: +61 29 691 8815 Fax: +61 29 691 8833
	Dubai	Emirates	Tel: +97 15 06 24 6628 Fax: +97 14 70 36 889
	Hong Kong	Cathay Pacific Airways	Tel: +852 2747 2509 Fax: +852 2322 6647
	Prague	Police/Airport authorities	
	Singapore	Singapore Airlines	Tel: +65 541 4562 Fax: +65 545 8227

PUBLICATIONS

Company Publications connected with flight operations and engineering:

- Aircraft type FLIGHT OPERATIONS MANUALs, QRH, Flight Manuals and MEL
- Engineering expositions
- Cabin Crew Manual
- Operations Policy Manual
- Airport Services Manual
- Ground Handling Manual
- Security Manual
- Company Emergency Procedures Manual
- Aircraft type Loading Manuals

Other Books and Publications:

- *IATA Dangerous Goods Regulations. Obtainable from:

  For customers in Africa, the Americas, Europe and the Middle East:

Customer Services Representative	Tel: +1 514 390 67
International Air Transport Association	Fax: +1 514 874 9659
800, Place Victoria	email: sales@iata.org
PO Box 113, Montreal, Quebec	Web: www.iata.org
Canada	

  For customers in Asia, Australia and Oceania:

77, Robinson Rd.	Tel: +65 438 4555
No. 05-00 SIA Building	Fax: +65 438 4666
Singapore 068896	

  *Also available in Chinese, French, German and Spanish language versions.

- The ICAO Convention and Annexes (***Refer to Annex 13***). Obtainable from:

ICAO Document Sales Unit	Tel: +1 514 914 8219
999, University St.	Fax: +1 514 954 6077
Montreal, Quebec H3C 5H7	email: icaohq@icao.org
Canada	Web: www.icao.int

- The United States FAR/AIM (Federal Aviation Regulations and Airman's Information Manual).

Federal Aviation Administration	Tel: +1 202 267-3883
800 Independence Ave SW	+1 202 267-3333 after hours
Washington, DC 20591	Web: www.faa.gov
USA	

  FARS
  www.faa.gov/avr/afs/fars/far_idx.htm

AIM
www.faa.gov/atpubs/AIM/AIMTOC.HTM

Also obtainable on CD-ROM.

Aviation Supplies and Academics
7005 132nd Place SE
Newcastle, Washington 9059-3153
USA.

Web: www.asa2fly.com/asa

- Joint Aviation Authorities Europe Regulations
  Saturnusstraat 8-10
  PO Box 3000
  2130 KA Hoofddorp
  Netherlands

  Fax: (31) (0) 23-5621714
  Web: www.jaa.nl

JARs
Can be ordered online at:
www.jaa.nl/catalogue/pubcat.html#cat7

The following publications contain useful information, which can be adapted to suit a particular operator's needs where the State does not provide an equivalent:

- The UK Civil Aviation Act
- The UK Air Navigation Order
- Air Operators Certificates - Information for Applicants and Holders
- The Mandatory Occurrence Reporting Scheme (CAP 382)
- JAR-OPS 1
- Training in the Handling and Carriage of Dangerous Goods (CAP 698)
- Ramp Safety Manual (CAP 642)

All the above (including a full catalogue of UK CAA publications) can be obtained from:

Westward Digital Ltd.

Web: www.westward.co.uk

Greville House
37 Gratton Rd.
Cheltenham, Gloucestershire, GL50 2BN
England

Books that may be considered to be essential reading include:

Flying the Big Jets (Stanley Stewart)
The Final Call (Stephen Barlay)
How Safe is Flying? (Laurie Taylor)
The Naked Pilot and *Handling the Big Jets* (David Beatty)

Aviation Safety Programs - a Management Handbook, 2nd Edition (Richard H. Wood)
Aircraft Accident Investigation (Richard H. Wood and Robert W. Swegennis)
ICAO Accident Prevention Manual (ICAO Document 9422-AN/923)

Aviation accident information publications containing accident summaries, loss records and statistics can be obtained on subscription from:

Airclaims, Ltd.
Cardinal Point
Newall Rd.
Heathrow Airport, London, TW6 2AS
England

Web: www.airclaims.co.uk

Airbus Industrie specialist publications:

Coping with Long-Range Flying
Getting to Grips with CAT II/CAT III Operations
Getting to Grips with the Cost Index
Getting to Grips with ETOPS
Getting Hands-On Experience with Aerodynamic Deterioration
Required Navigation Performance

Obtainable from:
Airbus Industrie Customer Services
Airlines Operations Support
1, Rond Point Maurice Bellonte
31707 Blagnac Cedex
France.

Tel: +33 (0) 5 61 93 3015
Fax: +33 (0) 5 61 93 2968/4465
SITA: TLSB17X
Telex: AIRBU 530526 F
Web: www.airbus.com

Boeing Commercial Airplane Group information:

The Role of Human Factors in Improving Aviation
http://www.boeing.com/commercial/aeromagazine/aero_08/human.html

FOD Prevention Program
http://www.boeing.com/commercial/aeromagazine/aero_01/s/s01/index.html

Aging Airplane Systems
http://www.boeing.com/commercial/aeromagazine/aero_07/agingair.html

Promoting Future Aviation
http://www.boeing.com/commercial/safety/safe_future.htm

Contact information:
Boeing Commercial Airplane Group
Boeing Airplane Services,
P.O. Box 3707,
MC 7R-72,
Washington 98124-2207
USA

Tel: +1 425-865-7950
Fax:+1 425-865-7896
Email: airplaneservices@boeing.com
Web: www.boeing.com

INDUSTRY ORGANISATIONS

African Aviation Safety Council (AFRASCO)
PO Box 19085
Nairobi
Kenya
Tel: +254 2 823000 x2083
Fax: +254 2 823486

The regional air safety organisation for Eastern, Central and Southern Africa (formerly known as ECASAFI).

Air Transport Association of America (ATA)
1301 Pennsylvania Avenue NW
Suite 1100
Washington DC 20004-1707
USA
Tel: +1 202 626 4015
Fax: +1 202 626 4019
Web: www.air-transport.org

The trade and service organisation of U.S. airlines.

Arab Air Carriers Organisation (AACO)
PO Box 13-5468
Beirut
Lebanon
Tel: +961 1 861297
Fax: +961 1 603140
SITA: BEYXAXD

The trade and service association for Arab airlines. Contact the Secretary General.

Association of Asia Pacific Airlines (APAA), Secretariat
S/F, Corporate Business Centre
151 Paseo de Roxas, 1225 Makati,
Metro Manila
The Philippines
Email: orienta@asiaonline.net
Web: www.aapa.org.ph

The trade and service association for major Asian airlines. Contact the Secretariat.

Bureau of Air Safety Investigation (BASI)
Department of Transport and Regional Services
PO Box 967
Civic Square, ACT 2608
Australia
Tel: +61(0) 2-6274 7111
+61(0) 6-257 4150
Fax: +61(0) 2-6274 6474
Web: www.basi.gov.au

Australia's government air accident investigating authority. Publishes periodic reviews of aircraft accidents and incidents in its *'Asia-Pacific AIR SAFETY'* journal.

Flight Safety Foundation
601 Madison Street, Suite 300
Alexandria, VA 22314
USA
Tel: +1 703 739 6700
Fax: +1 703 739 6708
Web: www.flightsafety.org

A non-profit organisation founded in the 1940s. It offers an impartial clearinghouse to disseminate objective safety information and promotes major flight safety seminars globally. The FSF also publishes seven scheduled periodicals and engages in special projects and studies to identify threats to safety, research problems and recommend practical solutions.

International Air Transport Association
800 Place Victoria
PO Box 113
Montreal, Quebec H4Z 1M1
Canada
Tel: +1 (514) 874-0202
Fax: +1 (514) 874-9632
Web: www.iata.org

International Association of Latin American Air Carriers (AITAL) *(Asociacion Internacional de Transportadores Aereos Latinoamericanos)*
Apartado Aereo 98949
Bogota
Columbia
Tel: +57 1 2957972
Fax: +57 1 4139178
Email: aital@latino.net.co

The regional air safety organisation for Latin America.

International Federation of Airline Pilots Association (IFALPA), Interpilot House
Gogmore Lane
Chertsey, Surrey, KT16 9AP
England
Tel: +44 (0) 1932 571711
Fax: +44 (0) 1932 570920
email: admin@ifalpa.org
Web: www.ourworld.compuserve.com/hompages/ifalpa

Contact the Executive Director.

National Transportation Safety Board (NTSB)
490 L'Enfant Plaza East, SW
Washington, DC 20594-2000
USA
Tel: +1 202 314-6100
Web: www.ntsb.gov

The U.S. government agency responsible for the investigation of aircraft accidents. Refer to NTSB Regulation ***Part 830***.

Transportation Safety Board of Canada
Place du Centre
200 Promenade du Portage, 4th Floor
Hull, Quebec
Canada
Tel: +1 819 994 3741
Fax: +1 819 997 2239
Web: www.bst-tsb.gc.ca

The Canadian government air accident investigation authority.

UK Air Accidents Investigation Branch
Department of Transport
DRA Farnborough, Hampshire, GU14 6TD
England
Tel: +44 (0)1252-510300
Fax: +44 (0)1252-376999
Web: www.open.gov.uk/aaib

The U.K. governments air accident investigating authority. Publishes a monthly list of aircraft accident reports.

UK Civil Aviation Authority
Safety Data Department
Aviation House, Gatwick Airport South
West Sussex, RH6 0YR
England
Tel: +44 (0)1293-573220
Fax: +44 (0)1293-573972
Web: www.caa.co.uk

Maintains the UK Civil Aviation Authority's occurrence database. Publishes a monthly list of reported occurrences, together with brief details and status, and an amplified digest of selected events. Available on subscription.

The United Kingdom Flight Safety Committee
The Graham Suite, Fairoaks Airport
Chobham, Woking, Surrey, GU24 8HX
England
Tel: +44 (0)1276-855193
Fax: +44 (0)1276-855195
Email: KFSC@compuserve.com

Founded in 1959. Composed of experienced flight safety professionals drawn from UK airlines and associated industry agencies. The Committee, whose aim is to pursue the highest standards of flight safety for public transport operations, meets formally eight times a year. Full membership is available to European airlines and professional associations, and affiliated membership is offered to non-European airlines. Contact the Executive Secretary for details.

International Society of Air Safety Investigators
Technology Trading Park
Five Export Drive
Sterling, VA 20164-4421
<u>USA</u>

Tel: +1 703 430 9668
Fax: +1 703 450 1745
Email: hq@isasi.org
Web: www.isasi.org

'TRAINING ORGANISATIONS

The following reputable institutions provide formal courses in Flight Safety Management, Aircraft Accident Investigation and allied subjects. Courses are usually residential and vary from two to six week's duration:

Cranfield College of Aeronautics,
Cranfield, Bedfordshire, MK43 0AL
<u>England</u>

Tel: +44-1234-750111
Web: www.homoe.coa.ac.uk/ccoa_test/index.htm

SAS Flight Academy
SE-19587, **Stockholm**
<u>Sweden</u>

Tel: +46-8-797-4242
Fax: +46-8-797-4241
Web: www.sasflightacademy.nu

Southern California Safety Institute (SCSI)
3838, Carson St.
Suite 105, **Torrance CA 90503**
<u>USA</u>

Tel: +1 (310) 540 2162
Fax: +1 (310) 540-0532
Email: scsi@ix.netcom.com
Web: www.scsi-int.com

Embry-Riddle Aeronautical University
600 S. Clyde Morris Boulevard
Daytona Beach FL 32114-3900
<u>USA</u>

Tel: 1-800-222-3728
Email: admit@db.erau.edu
Web: www.erau.edu

(Graduate and undergraduate courses are available from SCSI and Embry-Riddle)

Accident Investigation Bureau
Lisbon
<u>Portugal</u>
(Courses conducted in Portuguese)

Institut Francais de Securite Aerienne
2, Place Rio de Janeiro
75008 Paris
<u>France</u>
Courses conducted in French

Tel: +33 1 44 95 29 41
Fax: +33 1 44 95 29 41

Institute of Aviation Safety (IAS)
c/o Swedavia/Luftfartsverket
S-601 79 Norrkoeping
<u>Sweden</u>
Courses conducted in English

Tel: +46 11 192000
Fax: +46 11 130711
Email: swedavia@swedavia.lfv.se
Web: www.swedavia.com

University of Southern California
Aviation Safety Program
Los Angeles, CA 90089-8001
USA

Tel: +1 213 743-4555
Fax: +1 213 748 6342
Email: barr@bcf.usc.edu
Web: www.usc.edu/dept/engineering/AV.html

Specialised training in cabin safety and associated research is available from:

The Civil Aeromedical Institute (CAMI)
FAA-AAM-630
PO Box 25082
Oklahoma City, OK 73125
USA

Tel: +1 405 954 5522
Fax: +1 405 954 4984
Web: www.cami.jccbi.gov

Hands-on instruction is provided in the use of cabin and cockpit safety equipment (oxygen systems and equipment, fire-fighting equipment, personal survival equipment, etc). There are also practical aircraft slide evacuation and ditching exercises and live decompression training - probably the only decompression training facility accessible to the civil aviation community. The three-day (non-residential) course is free. Participants must be in possession of a current FAA Class 3 medical certificate (or equivalent) to be accepted for decompression training.

MANUFACTURER INFORMATION

Airbus Industrie GMT +1
1 Rond Point Maurice Bellonte
31707 Blagnac Cedex
France

Boeing Commercial Airplane Group (BCAG) GMT -8
P.0. Box 3707 Mail Stop 14-HM
Seattle, WA 98124
USA
General Office (206) 655 8525
Pager (206) 986 6327
24hr Switchboard (206) 655 2121

Bombardier Aerospace GMT -5
P.O. Box 6087
Station Centre-ville
Montréal, Québec H3C 3G9
Canada
Tel: 1 (514) 855-5000
Fax: 1 (514) 855-7401

Cessna Aircraft Company GMT -6
Mid-Continent Facility (Corporate Offices)
P.O. Box 7704
1 Cessna Blvd.
Wichita, KS 67215
USA
Corporate Office (316) 517-6000

de Havilland	GMT -5
Garratt Blvd.	
Downsview, Ontario M3K 1 Y5	
Canada	
General Office	(416) 375 4158
	(416) 375 4278
After Hours	(416) 674 7320
	(416) 674 7321

EMBRAER - Empresa Brasileira de Aeronautica S.A.	GMT -3
Av. Brig. Faria Lima, 2170 - Putim	Tel: + 55 12 345-1000
12227-901 - S. Jose dos Campos - SP	Fax: + 55 12 321-8238
Brazil	

Fokker Aircraft B. V.	GMT +1
P.0. Box 12222	
1100 AE Amsterdam Zuidoost	
The Netherlands	

GE Aircraft Engines	GMT -5
Engineering Division	
Mail rop: J-60	
1 Neumann Way	
Cincinnati, OH 45215-630	
USA	
General Office	(513) 243 4659
	(513) 243 4660

Lockheed Aeronautical Systems Company	GMT -5
86 South Cobb Drive	
Marietta, GA 30063-0444	
USA	
General Office	(404) 494 4861

Pratt and Whitney Aircraft Engines	GMT -5
400 Main St.	
East Hartford, CT 06108	
USA	
24 Hour number	(203) 727 2000

Rolls Royce Aircraft Engines	GMT 0
P.0. Box 31	
Derby DE2 8BJ	
England	
Customer Support	(44 332) 248 232

SNECMA GMT +1

Department Securite des Vols - YDES
Direction Technique
77550 Moissy Cramayel
France
General Office 33 1 60 59 82 54
33 1 60 59 98 91

SUPPLIERS OF FLIGHT/PERFORMANCE MONITORING SYSTEMS

AvSoft Ltd.
Myson House
Railway Terrace
Rugby
Warwickshire, CV21 3HL
England

Tel: +44 (0) 1788 540898
Fax: +44 (0) 1788 540933
email: sales@avsoft.co.uk
Web: www.avsoft.co.uk

British Airways (S742)
PO Box 10
Heathrow Airport, TW6 2JA
England

Tel: +44 (0) 181 513 0225
Fax: +44 (0) 181 513 0227
Email: fdradmin@british-airways.com

The Sabre Group: Offers a consulting service through 10 offices world-wide.
Contact through the Web at www.sabre.com.

The Flight Data Company Ltd.
The Lodge
Harmondsworth Lane
West Drayton, Middlesex, UB7 0LQ
England

Tel: +44 (0) 181 759 3455
Fax: +44 (0) 181 564 9064
Web: www.fdata.demon.co.uk

Bureau of Air Safety Investigation
Dept. of Transport & Regional Services
INDICATE Program
Air Safety Investigation
PO Box 967, Civic Square
Canberra ACT 2609
Australia

Tel: (02) 6274 6468
Fax: (02) 6247 1290
Web: www.basi.gov.au/indicate/index.htm

Note : The INDICATE Program software can be downloaded at no cost from the BASI web-site, http://www.basi.gov.au, or can be obtained from the above address.

Penny & Giles Aerospace Ltd.
6, Airfield Way
Christchurch, Dorset, BH23 3TT
England

Tel: +44 (0) 1202 481771
Fax: +44 (00 1202 484846
Web: www.users.dircon.co.uk/~pgdata/index.htm

Honeywell/Allied Signal Inc. Electronic & Avionics Systems Air Transport & Regional Mail Stop M/S 39, PO Box 97001, 15001 N.E. 36th Street, Redmond, WA 98073-9701 <u>USA</u>	Tel: (425) 885-8461 Fax: (425) 885-8319 Web: www.honeywell.com
Avionica, Inc. 14380 SW 139th Ct. Miami, FL 33186 <u>USA</u>	Tel: (305) 559-9194 Fax: (305) 254-5900 Web: www.avionica.com
Austin Digital, Inc. 3913 Medical Pkwy. Austin, TX 78756-4016 <u>USA</u>	Tel: (512) 452-8178 Fax: (512) 452-8170 Web: www.ausdig.com
L3 Communications Fairchild Recorders PO Box 3041, Sarasota, FL 34230 <u>USA</u>	Tel: (941) 377-5500 Fax: (941) 377-5509
sfim Industries Civil Aviation Department 13, avenue Marcel Ramolfo Garnier 91344 MASSY Cedex <u>France</u>	Tel: 33 1 69 19 67 03 Fax: 33 1 69 19 69 17 Web: www.sfim.com
Teledyne Controls Flight Information Management Systems 12333 W. Olympic Boulevard Los Angeles, CA 90064 <u>USA</u>	Tel: (310) 442-4275 Fax: (310) 442-4324 Web: www.teledyne-controls.com

INTERNET WEB SITES

Airbus Industrie Home Page	www.airbus.com
Aircraft/Fire Safety	www.fire.tc.faa.gov
Air Safety Home Page USA	www.airsafe.com
Arab Air Carriers Organisation (AACO)	www.aaco.org
Aviation Link Index	www.connections.co.nz/squelch/aviation_links_page.htm
'Aviation Week'	www.aviationnow.com
BASI Australia	www.dot.gov.au/programs/basihome
Boeing Home Page	www.boeing.com
Civil Aviation Aeromedical Institute (CAMI)	www.cami.jccbi.gov
Commercial Aviation Computer-related Incidents	www.rvs.uni-bielefeld.de/publications/Incidents/
EUROCONTROL	www.eurocontrol.be
Flight Safety Foundation	www.flightsafety.org
Global Aviation Information Network	www.gainweb.org
ICAO	www.icao.int
International Federation of Airworthiness	www.ifairworthy.org/
Swedish Board of Accident Investigation	www.havkom.se/english
Transportation Safety Board of Canada	www.bst-tsb.gc.ca/airlist
UK Air Accident Investigation Branch	www.open.gov.uk/aaib/aaibhome.htm
UK AIC (Aeronautical Information Circulars)	www.ais.org.uk/publications.htm
University of Southern California	www.usc.edu/dep/issm/AV.html
US Aviation Safety Reporting System (ASRS)	www.olias.arc.nasa.gov/ASRS/ASRS
US Federal Aviation Administration (FAA)	www.faa.gov
US National Transportation Safety Board (NTSB)	www.ntsb.gov/Aviation/aviation

APPENDIX C

ANALYTICAL METHODS

&

TOOLS

APPENDIX C TABLE OF CONTENTS

GAIN Working Group B has completed an inventory of analytical methods and tools "potentially useful" to airline flight safety offices. One-page summaries of the tools identified follow. An overview of the tools listed is found below:

METHODS & TOOLS LISTED BY CATEGORY

Accident/Incident Reporting Systems
Tools
ATA Aviation Safety Exchange System (AASES)
Aviation Safety Information System (AvSIS)
Aviation Quality Database (AQD)
British Airways Safety Information System (BASIS)
Sabre AIRSAFE
No Methods Included

Cost/Benefit Analysis
Tools
Boeing Digital Technologies Cost Model
Airbus Service Bulletin Cost Benefit Model
No Methods Included

Data Mining/Data Visualisation
Tools
IMPACT
SPOTFIRE
MITRE Aviation Safety Tool (MAST)
ADAM (Aerospace Data Miner)
IDS (from NRC of Canada)
No Methods Included

Descriptive Statistics
Tools
ITMS Analysis Tools
Statgraphics Plus *(also under Trending)*
Microsoft Excel *(also under Trending)*
No Methods Included

FOQA/Digital Flight Data Analysis
Tools
AIRBUS Quality Assurance System (AQAS)--*Airbus*
Analysis Ground Station (AGS)--*Sfim, Inc.*
Aviation Performance Measuring System (APMS)--*NASA*
AVSCAN--*Avionica*
Daily Flight Operation Monitoring (DFOM)--*Japan Airlines*
Event Measurement System (EMS)--*Austin Digital, Inc.*
Flight Data Replay and Analysis System (FLIDRAS)--*Teledyne Controls*
Ground Recovery and Analysis Facility (GRAF)--*Flight Data Company (FDC)*
Performance Measurement Management Information Tool (PERMIT)--*FDC*
No Methods Included

Human Factors Analysis
Tools
Aircrew Incident Reporting System (AIRS)
Computer-Assisted Debriefing System (CADS)
Flight Crew Human Factors Integration Tool
Human Factor Analysis and Classification System
Procedural Event Analysis Tool (PEAT)

Methods
Reason Model, Bayesian Belief Network
Integrated Process for Investigating Human Factors
Reason Model
Techniques for Human Error Rate Prediction (THERP)
Maintenance Error Decision Aid (MEDA)

Occurrence Investigation and Analysis
Tools
TapRooT

Methods
Integrated Safety Investigation Methodology (ISIM)
Causal Factor Modelling (s*pecific M/Ts to be determined)*
Multi-Layer Model for Incident Reporting and Analysis System
Integrated Process for Investigating Human Factors *(also under Human Factors)*
Multilinear Events Sequencing (MES)
Sequential Procedures Timed Events Plotting (STEP)

Risk Analysis
Tools
@ Risk
Fault Tree Analysis (FTA); FaultrEASE
Event Tree Analysis (ETA)

Methods
Flight Operations Risk Assessment System
Operations, Safety, & Risk Analysis Using Data Systems as Tools
Neural Networks
Probabilistic Risk Assessment (PRA)
Control Rating Code (CRC) Method
Fleet Risk Exposure Analysis (ARP 5150)
Rannoch Corp., Aircraft Performance Risk Assessment Model

Trend Analysis
Tools
Statgraphics Plus
Microsoft Excel

Methods
Characterisation/Trend/Threshold Analysis
Trend Analysis, Statistical Process Control, Time Series Analysis

METHODS & TOOLS ONE PAGE SUMMARIES

INCIDENT/ACCIDENT REPORTING SYSTEMS

Title: ATA Aviation Safety Exchange System (AASES)

Information Source: "ATA Safety Information Sharing", Bill Bozin's presentation at the Third GAIN World Conference, http://www.gainweb.org

Purpose: Identify trends not evident from a single carrier's operations in order to alert participating carriers to potential problems.

Description: AASES is an automated database of merged, de-identified incident data from member airlines. It examines data by aircraft type, incident category, incident type, location and frequency. Bar graphs and scatter diagrams are used to identify patterns and trends in the merged data that may not be evident from examining a single carrier's operations. AASES can alert operators to potential problems, and data and resultant information can be used to prevent accidents in two ways: individually by members, and collectively by ATA councils, committees and staff for mutual needs, as desired. This standardised information can increase the utility of the information, and converts the data into useful information.

Point of Contact: John Meenan or Paul Pike, ATA.

Comments: This looks like GAIN on a smaller scale. As of August 1999, analytical procedures for working with the AASES data had not been developed and the system was just a database, not an analytical tool.

INCIDENT/ACCIDENT REPORTING SYSTEMS

Title: AVSiS

Information source: AvSoft Ltd (Producer and vendor or AVSiS)

Purpose: AVSiS is a safety event logging, management and analysis tool, for Windows PCs (95,98 or NT).

Description: Events are divided into two groups, happenings (which are noteworthy but not actual incidents), and incidents. Most events recorded will be incidents. The Flight Safety Officer (FSO) on receipt of an event report enters the information into AVSiS. AVSiS presents easy to follow forms, with standard pick lists (for example; event type, phase of flight, etc.) and text fields to enable detailed description as required. The FSO may then request follow up reports from either internal or external departments (where the cause is assigned to an internal department, the FSO may also assign human factors(s)). A number of ready to use reports are available (for example; showing events graphically by location and/or severity). Graphical reports have the capability for the FSO to 'drill down' so that the underlying detail may be viewed. AVSiS enables the FSO to record the reports requested, and the reply by date. AVSiS also enables the FSO to run reports showing the status of requested information by department, thereby helping the FSO to ensure that investigations are conducted in a timely manner.

Event severity is assessed and recorded on two scales, one including and one excluding frequency (of the event). Once all the information about the event has been obtained, the FSO may record recommendations for actions to rectify any safety system weaknesses identified. As with requested reports, AVSiS enables the FSO to record recommendations made and whether or not the have been accepted and then implemented. All accepted recommendations must be implemented before the status of the event may be switched from open to closed. A high level of security is also provided, which may be set-up by the administrator.

AvSoft is also currently developing further advanced features for AVSiS. These include the unique AVSHARE system, which will enable users to share safety information via The Internet with other users. Users decide who may see what information; and the data is encrypted for maximum security. A further addition will be the Task Manager, which will include an electronic reminder system. AVSiS benefits airlines because it is easy to use, promotes good practise and it is affordable.

Point of Contact: Tim Fuller, AvSoft, +44 1788 540 898 or US toll free 1-800 926 3174, tfuller@avsoft.co.uk, www.avsoft.co.uk

Comments:

INCIDENT/ACCIDENT REPORTING SYSTEMS

Title: Aviation Quality Database (AQD)

Information Sources: Superstructure Computer Services, Ltd. web-site at http://www.superstructure.co.nz. Additional information found within *Aviation Safety Management*, prepared by the Civil Aviation Safety Authority Australia, April 1998.

Purpose: Provides tools for data gathering, analysis and planning for effective risk management. It offers functionality, and proven efficiencies in the fields of flight safety recording and quality assurance.

Description: Developed on the premise that the key to knowing what action to take to correct quality and safety deficiencies is to understand their root causes. AQD is a tool for implementing and managing comprehensive quality and safety systems. The database allows New Zealand aviation operators to be compatible with New Zealand CAA computer data (the international version allows customisation of input screens, fields, creation of unique occurrence reports without software changes – and even the database structure itself), and assists in compliance with regulatory reporting requirements. AQD can be used in applications ranging from a single-user database to include operations with corporate databases over wide-area networks. Features of the system include: the recording and analysis of occurrences such as incidents, accidents and events; the recording and tracking of quality deficiencies or improvements; a codified interpretation of the James Reason human factors model for determining causal factors, as developed by the New Zealand CAA; risk analysis and cost statistics. In addition, it has the basic elements of a quality system, including the tools to create an internal audit program; the ability to track corrective and preventative actions; integrate external audit requirements; and to analyse trends in quality indicators.

The "action tracking" module lets you track and manage corrective actions that result from a safety investigation or a quality improvement recommendation. This tool helps to ensure that the investment in flight safety and QA activities yields results. It shows priority areas that need urgent attention, wasting less management time, and maximising the effort spent on investigations. In addition, existing databases can be imported into AQD, whilst not losing the previous data or effort and resources used in their production.

Point of Contact: Sue Glyde, Partner, (mobile phone) 025 572 909, e-mail address: sue@superstructure.co.nz or contact Superstructure Computer Services, Ltd., Level 1, 282 High Street, PO Box 44-280, Lower Hutt, New Zealand, (phone) 644 570 1694, (fax) 644 570 1695. http://www.superstructure.co.nz/. Additional information can be obtained from the New Zealand CAA, (phone) 0011 64 4 5609400.

Comments: Additional benefits are available for New Zealand operators only.

INCIDENT/ACCIDENT REPORTING SYSTEMS

Title: British Airways Safety Information System (BASIS)

Information Source: BASIS Product Literature

Purpose: Gather, categorise, and analyse safety information including incident reports and digital data using modular system.

Description: BASIS was developed by safety professionals to answer questions, "How safe are we?", "Can we demonstrate it?" and "Where should we put our limited resources to become even safer?".

Air Safety Reports module captures safety reports from pilots and others and guides the assignment of keyword categorisations and the assessment of risk for the event.

Human Factors module assists in the investigation and characterisation of safety incidents involving actual or possible human error.

Flight Data Recording Exceedences (called "SES" or "SESBASE") module analyses how aircraft are being flown and includes a risk assessment component to assess the "severity" of all events.

Flight Instrument Replay (FIR) module produces an animation replay of instruments from a recorded flight.

Maxvals module records maximum values of many flight parameters, creates distributions over thousands of flights, and performs statistical analysis and modelling.

System Information Exchange (SIE) module allows member airlines to send a deidentified data extract of their air safety reports to the BASIS staff, where those reports are merged with similar reports from other member airlines into one global database that is then shared with all contributor airlines.

Point of Contact: Eddie Rogan, eddie.1.rogan@british-airways.com

Comments:

INCIDENT/ACCIDENT REPORTING SYSTEMS

Title: *AIRSAFE*

Information Source: AIRSAFE Business Plan, Version 1.0, October, 1999

Purpose: An information tracking, analysis, and distribution system

Description: *AIRSAFE* is comprised of three modules – one module for safety and risk management (Corporate Event Reporting System), one module maintains governmental reporting logs, OSHA 101 and OSHA 200 (OSHATrac), and the third module provides for worker's compensation and employee injury claims tracking (First Report).

The Corporate Event Reporting System (CERS) is an automated process that provides for comprehensive event data entry, storage, and retrieval of data on aircraft and passenger safety and security events as well as tracking property damage and safety trends. With CERS's notification module, contact information for on-hours and off-hours for each department or person is set up by event type so that only people who need to be notified are contacted. In addition, CERS can optionally interface with flight, maintenance and engineering, passenger, and employee information from other corporate systems to pull information automatically into the event record.

First Report provides a mechanism for employers to track employee injuries, prevent the causes, and get an employee back to work as soon as possible. First Report helps injury counsellors look for trends through ad-hoc reporting and eliminates potential safety risks.

The Occupational Safety and Health Act (OSHA) requires that employers record occupational injuries/illnesses as outlined by the Act and maintain these logs in a predefined format. OSHATrac allows the OSHA record keepers to access these logs and make corrections directly into the system in the format required. OSHATrac is a separate application written for the Safety Department that connects to the First Report database.

Point Of Contact: Kathryn Crispin, Sabre, Inc., 817/931-0253, kathryn.crispin@sabre.com

Comments: *AIRSAFE* addresses airlines' sizeable financial losses due to safety situations or events that cause damage to property, or impact the health or safety of passengers and personnel. The system also allows airlines to target and eliminate potential safety risks by tracking and analysing historical event trends. AIRSAFE can increase employee productivity, decrease the number of fraudulent claims, reduce claim over-payments and multiple payments, improve safety reporting standards, reduce government fines by reporting OSHA data in the format required, and allow for efficient management of the event escalation process.

COST/BENEFIT ANALYSIS

Title: Boeing Digital Technologies Cost Model

Information Source: Boeing Digital Technologies Cost Model CD-ROM, Microsoft Access, internal airline cost data

Purpose: To quantify the financial impact of delays and cancellations due to accidents and incidents on airlines.

Description: The Boeing Cost Model helps flight safety managers to justify enhancements to safety programs, as well as defining actual costs of accidents and incidents to airline senior management. It is a multi-purpose tool, which can be used by airline safety managers to assign costs to the out of service times of any aircraft type. In those airline environments where there is little or no internal development of these costs, the default values for each aircraft type can be used. For airlines which have a more mature internal cost model, the costs which have been developed can be "plugged in" to the Boeing cost model, ensuring a higher degree of accuracy and applicability to the particular airline.

The software is freely distributed by Boeing to any operator or interested party. It is based on Boeing's expertise, as well as inputs from their customers. The use of Microsoft Access as the engine for this system assures that the capabilities go beyond that of a simple spreadsheet, and allow more sophisticated analysis of the data. The software is intended to be customised by the user as they gain maturity and confidence in their own cost analysis. The cost modelling can be used by fixed based operators, repair, maintenance and overhaul organisations, and financial analysts. It is primarily intended as an airline tool. The Boeing cost model would be a starting point for an airline safety manager who has not yet developed accurate costs associated with incidents and accidents.

Point of Contact: Bob Wright, Trans World Airlines, (314) 551-1611, bwright@twa.com

Comments:

COST/BENEFIT ANALYSIS

Title: Airbus Service Bulletin Cost Benefit Model

Information Source: Service Bulletin Cost Benefit user manual, company information, and Service Bulletin Cost Benefit Microsoft Excel 97 software.

Purpose: To simplify the task of the airline in the selection and prioritisation of optional modifications to be embodied on their fleet.

Description: The Airbus Industrie Service Bulletin Cost Benefit Model serves Airbus Industrie to set targets for the design of solutions to in-service problems (except those related to safety). These targets are based on typical airline economical and operational parameters and give the "not to exceed" limits to offer cost-effective solutions for airlines. It also allows airlines to evaluate the proposed modification cost/benefit using their own economical and operational parameters.

The tool is provided free of charge to airlines and has a thorough analytical methodology that is based on a well established cost model. The values used in the model have been derived from marketing and reliability engineering, reflecting a wide range of inputs from operators world-wide. The tool is constantly updated as a function of economical developments.

Point of Contact: Matthias Schmidlin, NASA, 415-969-3969 x33

Comments: This tool is not an Aviation Safety Cost Benefit Analysis (ASCBA) tool. However, elements such as the model of delay and cancellation are certainly useful inputs in ASCBA approaches.

DATA MINING/DATA VISUALISATION

Title: Information Mining Performance Attainment Control Technique (IMPACT)

Information Source: CARE Homepage, http://care.cs.ua.edu

Purpose: To provide individual decision-makers within the traffic and aviation safety communities direct access to accident and incident information.

Description: IMPACT is the information mining processor within the Critical Analysis Reporting Environment (CARE), and is one of the most powerful tools within that software system in that it finds and prioritises over-representations without user intervention or even any knowledge of the underlying database. This module performs true automated information discovery by systematically finding all over-representations between any two subsets. Graphical and tabular outputs are arranged in order of worst-first order for each variable. As an example, a comparison of weather-related accidents with non-weather-related accidents will tell the most over-represented who, what, where, when, how and why, so that countermeasures can begin to be considered in the most critical areas. It displays these comparisons graphically as bar charts and tests these comparisons statistically (t-test) to see if the differences in counts or percentages are large enough to signal a "difference" between the two subsets. The capability of IMPACT to delve into potential causal relationships and countermeasures is only limited by the domains and labels of the data. Also, CARE users require no formal training in computer hardware or software.

Point of Contact: CARE Homepage, http://care.cs.ua.edu

Comments: IMPACT employs artificial intelligence methods.

DATA MINING/DATA VISUALISATION

Title: Spotfire Analysis Tools

Information Source: Spotfire web site, http://www.spotfire.com

Purpose: Create software solutions that empower scientists and engineers-and their enterprises-to make decisions that get products to the market first. Spotfire solutions combine data associated with ingredients, formulations and properties with knowledge of process and performance to optimise results and conduct trade-off analysis.

Description: Process Engineers continue to search and mine databases of quality information looking for trends and patterns associated with product defects that may stem from manufacturing processes, materials, suppliers, usage and other variables. Spotfire solutions help sort through this information and provide feedback that can be used in continuous process improvement. At the departmental level, Spotfire products can help extract greater value from investments that have been made in data generation. Research managers can go beyond making better use of data, to improving, fundamentally, the discovery process itself. It allows the construction of specific solutions that reflect the discovery process while inheriting the ease-of-use benefits of the standard products. Spotfire Pro, the flagship product, reads large amounts of multi-variable data originating from disparate data sources and automatically generating intelligent, interactive query devices for rapid identification of trends, anomalies, outliers, and patterns.

Point of Contact: Spotfire, Inc., 60 Hampshire Street, Cambridge, MA 02139

Comments:

DATA MINING/DATA VISUALISATION

Title: MITRE Aviation Safety Tool (MAST)

Information Source: MITRE Corporation (http://www.mitre.org)

Purpose: To provide in a single tool, capabilities for gathering, querying and analysing aviation incident reports.

Description: The MITRE Aviation Safety Tool is being developed as part of an internal research project in the application of data mining methods to aviation safety. The goal of this project is to build a tool capable of finding interesting patterns in both fixed fields as well as textual data that does not require extensive knowledge of machine learning or Information retrieval. The tool currently contains modules for data entry, reporting, association discovery and text retrieval, with additional capabilities planned.

The association discovery and text retrieval capabilities of this tool are not commonly available to aviation safety analysts. The association discovery tool efficiently searches through all combinations of available attributes for those groups that have strong correlations. Such correlations can be used to identify both strong trends and outliers. The text retrieval tool is designed to help analysts identify related incidents based on the text description rather than fixed categories.

Point of Contact: Trish Carbone, Technology Area Manager, MITRE Corporation, 703-883-5523, carbone@mitre.org.

Comments:

DATA MINING/DATA VISUALISATION

Title: Aerospace Data Miner (ADAM)

Information Source: Howard Poslun's report-out during a 10/20/99 telecon, and Institute for Information Technology's web site.

Purpose: To develop an easy to use domain specific software system that integrates data mining and monitoring techniques to support maintenance and operation of commercial aircraft.

Description: ADAM predicts failures and generates maintenance alerts such as warnings of an impending engine component failure or abnormal system operation. It draws data from various, readily available sources such as in-flight performance reports. ADAM provides real-time monitoring of aircraft status; facilities for advanced data analysis; and facilities for Data Visualisation. The system will make use of various sources of information such as: automatically generated reports (containing parametric data), automatically generated messages, and snag reports. ADAM is designed to work as an on-line or off-line system, and uses Machine Learning and Statistical Techniques to search for patterns and trends in the data to generate alerts.

ADAM was developed through "knowledge discovery". This method has been successfully commercialised and transferred to the microelectronic industry for chip manufacturing. This technology automatically generates rules. Applied to the airline industry, it has generated rules based on the Airbus troubleshooting manual. The ADAM software has been evaluated, based on some case studies and as an off-line system, by some Canadian fleet specialists and engineers. The results of the off-line evaluation have been very positive. Some benefits of ADAM include: reducing overall maintenance costs, reducing the number of delays, early identification of problems, and focussing attention on problematic cases.

Point of Contact: Institute for Information Technology web site, http://www.iit.nrc.ca

Comments: While applicable to all airlines, ADAM, which searches for complex data relationships, could be particularly useful for small carriers with limited data analysis capability. On a larger scale, information from multiple airlines could be pooled into a single, non-identified database to better pinpoint elusive problems.

DATA MINING/DATA VISUALISATION

Title: Integrated Diagnostic System (IDS)

Information Source: NRC's Integrated Reasoning Group research paper

Purpose: To develop a real-time remote monitoring system that focuses on troubleshooting procedures during turn-arounds.

Description: IDS is an applied artificial intelligence (AI) project that deals with remotely monitoring a fleet of commercial aircraft and proactively alerting maintenance staff to problems which could disrupt operations. These operations are carried out with limited time to complete diagnostics, repair, and testing. IDS takes all fault messages, including interpreting pilot messages, then groups similarities and applies reasoning rules. The rules refer to the Airbus troubleshooting manuals, maintenance history of the particular aircraft, and the maintenance history of the aircraft fleet and applies case-based reasoning. This allows real-time decisions based on up-to-date data and cooperate experience. The system uses a variety of different techniques to troubleshoot and diagnose the fault to make a recommendation. The system only makes a recommendation, with a human to make the final decision and take action. IDS requires the following attributes: availability of data, free access to systems and personnel, and a complex, distributed operation with significant impact of downtime.

IDS addresses all aircraft types and is data driven. The data driving it is stored in a multitude of dispersed databases of various vintages within the airline. Pertinent data are "pushed" to IDS and written to a database. These data are coupled with the interpretative logic within IDS then triggers certain maintenance actions. Once alerts are generated by IDS, it continues its "investigation" by requesting subsets of data to refine its recommendations.

Every time a message is received, IDS determines; whether or not the message belongs to an ongoing problem, is the start of something new, or can be ignored. The ideal result is clear, concise, and complete descriptions of fault events associating symptoms and correct repair actions.

Point of Contact: Institute for Information Technology web site: http://www.iit.nrc.ca

Comments: Once validated, these associations are added to a case database for future retrieval. Ultimately, this can lead to automatic case creation-seen as being highly useful by airline personnel.

DESCRIPTIVE STATISTICS

Title: Incident Trend Monitoring System (ITMS)

Information Source: ITMS web site, http://www.asy.faa.gov/itms

Purpose: This allows the user to visually compare the incident trend around a selected airport with the average trend for all airports of the same level.

Description: The airport's incident trend line is based on data extracted from seven aviation safety related databases over a sliding window. At this time users may choose a 6, 12, or 24 month window. An incident rate is computed for each of the months in the window and the trend line is the best fit to these points. The rates are based upon the number of incidents that occurred at or near the airport normalised to the number of airport operations. The incidents are pulled from the following databases: NTSB Aviation Accident/Incidents, FAA Accident/Incident Database (AIDS), Near Mid-air Collisions (NMACS), Pilot Deviations (PDS), Operational Errors and Deviations (OEDS), Vehicle/Pedestrian Deviations (VPDS), and Operations Database. A rising incident trend line at an airport may be an indication of a problem in the surrounding airspace, but is only the first step in any meaningful analysis. ITMS provides users with the ability to drill down to the individual incidents that compose the rates and read the incident reports. This is essential because the category of an incident may not be a useful indicator of what caused the event.

Point of Contact: NASDAC at FAA, Washington DC, 202-493-4247

Comments:

DESCRIPTIVE STATISTICS

Title: Statgraphics Plus *(Also under Trending)*

Information Source: Statgraphics Plus, User Manual, Version 6

Purpose: To retrieve information contained in a set of data and determine a relationship between different sets of data.

Description: Statgraphics Plus has more than 200 powerful statistical analyses to choose from and a host of innovative features. It has different screens to guide the user through every statistical analysis or graphics choice they make. It has the look and feel of Microsoft Windows, and is compatible with Windows NT, Windows 98, or Windows 95. Statgraphics Plus allows access to graphics in every procedure. It offers three different packages: Statgraphics Plus Standard Edition, Statgraphics Plus Quality and Design, and Statgraphics Plus Professional. The features involved are system, graphic, Design of Experiments, Quality Control, Life Data Analysis, and Other Analysis and Plots. With features like StatAdvisor give the user instant interpretations of results; StatFolio is a revolutionary new way to automatically save and reuse analyses; truly interactive graphics; StatGallery, letting the user combine multiple text and graphics panes on multiple pages; StatWizard guides the user through a selection of data and analyses; StatReporter allows the user to publish reports from within Statgraphics Plus; StatLink allows the user to poll data at user-specified intervals; Statgraphics Plus Professional gives the user all of the functionality found in the Quality and Design configuration plus analyses for time-series, multivariate methods, and advanced regression.

Point of Contact: StatGraphics Plus web site http://www.statgraphics.com/html/prod03.html

Comments:

DESCRIPTIVE STATISTICS

Title: Microsoft Excel *(Also under Trending)*

Information Source: Microsoft Office Product Guide

Purpose: To develop equations, results, charts, and tables for data.

Description: Microsoft Excel allows the user to analyse, report, and share their data. It has formula creation and natural language formulas that let the user build equations using their own terminology instead of cell co-ordinates. Formula AutoCorrect fixes common equation errors. Microsoft Excel provides a set of data analysis tools called the Analysis ToolPak that a person can use to save steps when developing complex statistical or engineering analyses. The appropriate statistical or engineering macro function displays the results in an output table. The statistics feature includes: linear best-fit trend, exponential growth trend, FORECAST function, fit a straight trend line by using the TREND function, fit exponential curve by using the GROWTH function, plot a straight line from existing data by using the LINEST function, plot an exponential curve from existing data by using the LOGEST function, and a Descriptive Statistics analysis tool. The ChartWizard consolidates chart building and formatting into one place. Microsoft Excel has features that include a range finder, conditional formatting, and allows access to URL's in formulas.

Point of Contact: Microsoft Office Web Site
http://www.microsoft.com/office/archive/x197brch/default.htm

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: AIRBUS Quality Assurance System

Information Source: UTRS

Purpose: To address airline management needs in term of operation visibility and quality indicators.

Description: The AIRBUS Quality Assurance System (AQAS) includes LOMS (Line Operation Management System) and LOAS (Line Operation Assessment System). LOMS is a system able to detect exceedances from a Flight Profile using downloads from Flight Data Recording Systems. This system retrieves deviations and engineering data (Flight Segments) and offers quick and easy access to them vial tools such as LOMIS (Line Operation Management Interface System, dedicated to statistic analysis) and the Flight Segment Analysis module. LOAS is a rolling audit system that is connected to the same database and that provides inside the cockpit assessment made by Check Captains. A special effort has been performed in order to integrate the whole system into a user-oriented interface.

Point of Contact: Emmeric Lachaud of Airbus, (33) 5 61 93 26 63, Emmerie.lachaud@airbus.fr

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: The Flight Data Company Ltd. Flight Data Animator

Information Source: UTRS

Purpose: To provide a suite of software tools for 3D animation of recorded aircraft data to support operational monitoring (FOQA) programs of the world's airlines.

Description: Flight Data Animator (FDA) is based on a system originally used for accident investigation work. FDA enables visualisation of operating procedures such as; takeoffs, approaches, go-arounds, etc. and helps identify potential areas for improvement in operating procedures and training curriculum. FDA communicates this information on what is happening during flying in a quick and easy-to-understand form. FDA integrates directly with FDC's and other FOQA tools and runs on the same hardware as the simulator debriefing system CADS. It can act as a 'pre-briefing' tool to highlight key learning objectives before a session starts. FDA can produce video output and form part of a wider briefing and training resource pack for pilots. FDA has a path correction technique which is a unique and easy-to-use method of accurately positioning the aircraft relative to the ground, based on many years of accident investigation development.

Point of Contact: Peter Clapp, 44 (0) 181 759 3455, http://Peter.Clapp@flightdata.co.uk

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Sight, Sound, and Motion FltMaster

Information Source: UTRS

Purpose: To provide 3-D animation and flight data replay using a suite of visualisation tools able to accept data from simulations, manned-motion simulators, and recorded flight data in virtually any format.

Description: FltMaster tools are being used in aircraft design, airline accident and incident investigations, and in the FOQA program. Development initiatives include advanced mission rehearsal and debriefing systems using real-time, photo-realistic graphics operating on an ordinary PC platform. Other initiatives are flight data analysis using automated event detection by statistical process control and replay with one-touch animation. FltMaster is capable of simulating or animating any air vehicle. It has a comprehensive tool set that provides a common engineering environment for all phases of an aircraft's life cycle, from preliminary design through operational analysis. The architecture of the software and the graphic-user-interface (GUI) were designed to maximise engineering productivity visualisation displays are understandable to anyone. The FltMaster simulation is architected with a simple, but powerful mode library design. It enables the user to rapidly construct simple or sophisticated simulations of any vehicle type. The model library is well-stocked with industry-accepted models, but readily integrates any custom user models coded in C++, C, or FORTRAN. FltMaster visualisation displays are designed to convey data through use of 2D/3D graphics. The display library includes a real-time view of the flight vehicle, instrument gauges, region maps, flight envelopes, special orientation graphics, and more. A plotting tool is embedded that allows graphical analysis of any set of flight parameters. The visualisation is fully adaptable, and accepts any custom user displays.

Point of Contact: Rick Willard, Vice President, 805-497-9603, http://www.ssmotion.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: FlightViz

Information Source: UTRS

Purpose: To allow non-programmers to quickly and easily create fully interactive, high fidelity, 3D graphical representations of aircraft flights.

Description: FlightViz is a modern, open-architecture, non-proprietary system that can be easily extended through either the public Object API or Component API. The Object API facilitates user addition of new display, input, output or computational objects through a C++ API. The Component API enables integration of FlightViz display components in other application programs. FlightViz Player applications reduce the cost of distributing animations by incorporating only the software necessary for replay. It can create these representations of aircraft flight from FDR or QAR data, as well as other sources including radar, ATC, real-time wireless telemetry and constructive or live simulations. FlightViz is designed with a fully open architecture which makes maximum use of existing systems and graphical assets. It is designed to interface with the most common commercially available readout stations, scene/object modelling tools, and simulation systems. FlightViz provides a mechanism to convert existing, dimensionally precise, visually correct, valuable training simulator visual databases to a format suitable for use on desktop workstations, thereby saving time, money and preserving consistency between training simulators and desktop devices. FlightViz is hosted on the complete line of Silicon Graphics 3D workstations as well as PCs running Windows NT. FlightViz is being used for FOQA and AQP/training applications.

Point of Contact: Steve Lakowske, 303-545-2132, http://www.simauthor.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Flight Data Acquisition and Management System (FDAMS)

Information Source: Honeywell

Purpose: To provide access to multiple flight data functions in a single unit.

Description: The functions of FDAMS include: Digital Flight Data Acquisition Unit (DFDAU) to provide a mandatory data stream to the FDR, Aircraft Condition Monitoring System (ACMS) to provide user-reconfigurable event detection and troubleshooting on a non-interference basis with the mandatory DFDAU function, Digital ACMS Recorder (DAR) to store continuous recording, and the Quick-Access Recorder (QAR) to store an exact duplicate of the aircraft-specific FDR recording stream to the PC-Card. FDAMS can contain up to 10 aircraft-type specific DFDAU databases, which are recognised via pin-programming at the time the unit is installed, providing part number commonality across multiple aircraft types. The DFDAU databases can be updated by software modification in response to new parameter processing mandates. The basic FDAMS configuration contains a set of standard ACMS Reports for engine and airframe monitoring, which can be added to or modified using the ground-based FDAMS Reconfiguration Tool. The Reconfiguration Tool includes the proprietary logic-algorithm builder called VADAR. Avionics engineers use the visual VADAR software to create, save and test the algorithms for loading into the airborne FDAMS unit. The VADAR software is used to: create and customise reports; create and modify data collection algorithms and recordings; and define output rules and formats. A FDAMS Readout software tools is used to read-out the collected data.

Point of Contact: Matt Glenn, (425) 885-8388, MATTHEW.GLENN@HONEYWELL.COM

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Analysis Ground Station (AGS)

Information Source: UTRS

Purpose: To provide report generation from manual data selection, import/export functions, numerous expanded programming capabilities, advanced analysis, and database management features.

Description: The Analysis Ground Station (AGS) is a Windows NT 4 compatible replay and analysis system developed by SFIM Inc. designed for mono-user or multi-user applications. It can be interfaced with any QARs/FDRs around, whatever the source of aircraft. In the operation-oriented application, AGS has flight operations monitoring with routine event detection and exceedance detection capabilities. AGS also has Flight Efficiency Monitoring (FEM) which can calculate the operational costs of the aircraft, fuel burn, and flight time.

In an automatic analysis AGS can analyse and process all data available from recorder in order to provide a customised report as requested for such analysis. AGS has a processing time of less than 5 seconds for 1 hour recording. AGS creates an analysis report showing events with classification levels, gives a flight and event data base update, and shows various trend monitoring processed (engine, aeroplane performance, etc.).

During the manual and on-event analysis, AGS provides efficient graphic user's interface to view quickly all pertinent data for troubleshooting understanding. AGS has preformatted parameter sets to have quick access to pertinent data including tabular data, cockpit animation, landing graphic representation, and external data file output/input.

The SFIM Ground Support Equipment (GSE) is the programming tool used to program Digital Flight Data Acquisition Units (DFDAU) and Data Management Unit functions. It is designed to create a work environment similar to the AGS.

Point of Contact: Rick Charles, Vice President of Marketing for Air Transport Products, 770-642-4255, http://Rickcharles@mindspring.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Aviation Performance Measuring System (APMS)

Information Source: NASA, Ames
http://human-factors.arc.nasa.gov/projects/IHS/aviationperf.html

Purpose: To provide an integrated suite of tools to ease the large-scale implementation of flight-data analyses within each of the air services providers.

Description: APMS develops and documents the methodologies, algorithms, and procedures for data management and analyses to enable users to interpret easily their implications regarding the safety and efficiency of operations. It is a developer of system guidelines and an engine of technology transfer to the U.S. aviation industry and to the vendor community, that serves it. APMS offers to the air-transport community an open, voluntary standard for flight-data-analysis software-a standard that helps to ensure suitable functionality and interchangeability among competing software programs. APMS has the ability to retain data from all the flight from which the full population can be determined for recorded flight parameters and combine its data with that from the Aviation Safety Reporting System (ASRS).

The APMS is developing the next generation of tools for the U.S. Flight Operations Quality Assurance (FOQA) program. It has been recognised as key to the future development of the system-wide monitoring capability of the Aviation Safety Program. The system will eventually be extended t service the needs of engineering, maintenance, and training in the airlines, and to commuter, cargo and corporate air carriers.

Point of Contact: Dr. Irving Statler, NASA Ames, (650) 6655, istatler@mail.arc.nasa.gov

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Avionica, Inc. AVSCAN

Information Source: UTRS

Purpose: To allow the user to portray informational parameters in any desired combination and/or time perspective and view them in engineering unit and graphic formats simultaneously.

Description: The Avionica AVSCAN system incorporates: 1) AVSCAN.flight for individual flight data review and analysis software and 2) AVSCAN.fleet for fleet wide automated data analysis and reporting solution for FOQA. AVSCAN.flight enables the user to display recorded events from selected flights or flight segments only minutes after the FDR is downloaded. AVSCAN.flight tailors to the user's analysis requirements. They can examine parameters in any quantity and/or combination, using the 'drag and drop' method, and view them immediately and simultaneously in engineering units and graphic formats. AVSCAN.flight was designed to promote safety, enhance maintenance troubleshooting, and simplify the extraction and analysis of data from FDRs and QAR's. It provides the user with a test function that shortens analysis time dramatically. AVSCAN.flight completes a search of all downloaded data for out-of-tolerance points, and provides a hardcopy of any view in graphic and tabular format.

AVSCAN.fleet was designed as a trend analysis system to support FOQA programs at all levels of complexity. It has inherent power to support any size fleet with any number of events, not just for the near term, but for operations well into the next century. AVSCAN.fleet provides general as well as detailed information for the user. It can instantly transition to an event and view it within the context of preceding and succeeding time frames surrounding the event. AVSCAN.fleet enables the user to filter and sort events by type, date, aircraft, or any number of criteria desired. Complementing AVSCAN's highly functional, turn-key implementation is AVSCAN's industry leading open, and standards compliant, architecture. This architecture, complete with an open database connectivity (ODBC) driver, serves as the foundation for future development from 3rd party developers and end users.

Point of Contact: Joseph Philipp, Director of Marketing, 305-559-9194, http://www.avionica.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Daily Flight Operations Monitoring (DFOM)

Information Source: Captain Teiichi Yagi's presentation at the Second GAIN World Conference, May 1997, London, U.K.

Purpose: To monitor, record, and analyse in-flight parameters of normal operations-not accidents or incidents.

Description: DFOM is managed by the Technical Services Department of Flight Operations. It is not used in accident or incident investigations but is used only to get daily/cycle information. DFOM tracks "wide-band events", exceedances of operating parameters by a certain pre-set margin or "trigger level". DFOM provides monthly feedback to all crewmembers, provides in-flight information to pilots via an in cockpit printer, provides perfect anonymity in that the pilot is never identified, has never lead to a pilot being disadvantaged, disciplined, or forced to attend additional training. The pilot name is only known to personnel of DFOM who use information from each flight to increase safety of all flights. DFOM data is also used for long-term trend analysis. Pilots can print their performance record after each landing using the cockpit printers. (DFOM is similar to FOQA programs in the U.S.)

Point of Contact: Captain Teiichi Yagi, 81-3-5756-3153

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Austin Digital, Inc. Event Measurement System

Information Source: UTRS

Purpose: EMS is designed to ease the large-scale implementation of flight-data analysis in support of the Flight Operational Quality Assurance (FOQA) Programs and Advanced Qualifications Programs (AQP).

Description: The Event Measurement System (EMS) is a highly configurable and adaptable Windows NT-based flight data analysis system. It is capable of easily managing large bodies of flight data, and can effortlessly expand with fleet size and changing analysis needs. As the operations grows, EMS will continue to extract maximum value from the flight data.

The EMS software components provide for configuration, automated processing and interactive analysis. The architecture of EMS has the highest level of automation of any FOQA/MOQA system available. The system has been designed to minimise labour, saving both the analyst's time and the airline's money.

The Austin Digital system strongly supports user configurability, allowing the end user to easily add fleet types and event and measurement definitions. The system was designed from the ground up to be user configurable, and hence the configuration options are complete and logically organised.

EMS includes database analysis software for analysis of the exceedances and measurements databases that allow a user to perform trending, drill-down and characterisation of the databases. With the Austin Digital system no programming is required for most analyses. The data can easily be exported to Microsoft Excel or Access.

EMS provides well-defined and rigorous security levels, enabling the appropriate amount of access to all users. All flight data is de-identified to all but the highest security level. And sensitive data is encrypted before it is stored. EMS can easily be integrated with systems of even the strictest security specifications.

Point of Contact: Ben Prager of Austin Digital, Inc., 512-452-8178, http://bap@ausdig.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Flight Data Replay Analysis System (FLIDRAS)

Information Source: UTRS, Teledyne Controls web site, http://www.teledyne.com

Purpose: To analyse flight crew performance as well as to monitor the aircraft systems and the health and condition of aircraft engines.

Description: The Flight Data Replay and Analysis System (FLIDRAS) supports the following capabilities: transcribing and archiving raw data and reports generated by airborne equipment, analysing raw data for operational events, reviewing reports from operational events, viewing flight data and operational events with powerful graphical and animation tools, and generating a wide variety of reports and export data files. The foundation of the FLIDRAS is an extensive database management system. Databases are used to define all aircraft, recorders, readers, recording media, data formats, parameter scaling, and analysis processing related to aircraft supported by FLIDRAS. Databases are also used to store, review, analyse and trend information generated by the FLIDRAS data analysis subsystem, as well as information generated by airborne data acquisition and processing systems.

FLIDRAS is a scaleable system that can run on a single notebook computer or a client/server network with a large-scale mainframe central server supporting large numbers of Windows NT workstations. A network configuration allows for multiple transcriptions, archiving, data analysis, and database operations to be performed simultaneously. Notification of the availability of new event/report information to users logged onto the system may be performed automatically. Optional user programmable data analysis programs (one for each aircraft type supported) are provided for ground based data processing. Data analysis programs are run each time recording media containing raw flight data becomes available, which may be on a daily basis. The operational database also supports the generation of daily and monthly trend and summary reports, as well as providing specialised output files for use in such other systems as aircraft performance monitoring programs (APM), manufacturer engine condition monitoring programs (ADEPT, SAGE, ECM II, TEAM III, COMPASS, etc.)

Point of Contact: Chuck Tamburo, FLIDRAS Program Manager, 310-442-4275, http://Charles_Tamburo@teledyne.com

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Flight Event Analysis Program (FEAP)

Information Source: Teledyne Corporation Web Site http://www.teledyne-controls.com

Purpose: To capture data and compare it to a database that contains minimum and maximum recommended parameter values for different phases of flight.

Description: FEAP is part of Teledyne Control's Flight Data Replay and Analysis System (FLIDRAS) which analyses flight crew performance as well as monitor aircraft systems and engines. The recommended parameter values are defined by the airline and/or airframe manufacturer and can be changed at the operators discretion through the use of the Flight Event Analysis Development Kit. Exceedance events are instances where the actual aircraft parameter exceeds what is recommended in the database for a particular phase of flight. The program utilises filtering and smoothing techniques which eliminates bad data from being processed as exceedance events. Actual events will generate a report. The events will include Flight Operational Exceedances, Engineering Exceedance Reports, Takeoff, Climb and stable Cruise snapshots for ECM and APM Reports.

Point of Contact: Teledyne Main Office, (310) 820-4616

Comments: This tool is for civil aviation industry use. Data sources include FDP data, Optical QAR data, tape QAR/DAR, and others.

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Ground Recovery & Analysis Facility (GRAF) for Windows and PERMIT

Information Source: UTRS and Flight Data Company (now Spirent Systems) web-site, http:// http://www.spirent-systems.com

Purpose: To obtain precise information about flight operations to help objectively evaluate a wide range of business issues.

Description: GfW combines a powerful and extremely flexible replay and analysis engine with an in-depth data investigation tool set. It includes a replay subsystem to convert data files retrieved from OQAR-equipped aircraft into engineering units for use in event analysis, and an analysis subsystem that automatically detects pre-defined FOQA events. GfW also includes an investigation subsystem that allows aircraft performance data to be displayed in trace or tabular formats. GfW includes a Logical Frame Layout editor to specify the data map for each aircraft. Additionally, GfW includes a user-configurable event editor, QuickCamel, that allows the user to specify basic events.

GfW also provides CAMELpro which is a fourth generation easy-to-use programming language that the Flight Data Company itself uses to develop turnkey systems. It gives the user full capability to write and test their own analysis routines. GRAF uses a unique event cache to automatically store portions of flight data around each event in an indexed temporary store. Users configure the time period around events and can mark those for permanent storage. All parameters are retained and kept in a compressed form for future investigation.

Performance Measurement Management Information Tool (PERMIT) is an event management tool that allows for the monitoring of trends in the event data, and presents the information in graphical or numerical formats to support the decision making process. PERMIT processes the flight and event information contained in the database created by GfW. The user is provided with tools to select the desired data; define, manipulate, and maintain one-time and periodic reports in both tabular and standard business graphic formats; and export data for use by other software tools such as Microsoft's Excel and PowerPoint. PERMIT also reduces the costs of running a flight data analysis system. It reduces the time needed to produce the monthly management reports, decreasing to a single mouse click what has traditionally taken hours or days to generate.

Point of Contact: Geoff Hughes of the Flight Data Company Ltd., 44 (0) 181 759 3455, http://Geoff.Hughes@flightdata.co.uk

Comments:

FLIGHT DATA MONITORING/FOQA ANALYSIS

Title: Software Analysis for Flight Exceedance (SAFE)

Information Source: Veesem Raytech Aerospace

Purpose: To help in the analysis of FDR data to identify any exceedances which might have occurred and are beyond the user's predefined range of certain parameters.

Description: To help airlines achieve FOQA compliance, Veesem Raytech Aerospace has developed a Windows-based software to analysis FDR data of every flight. Their approach is that in order to obtain a significant reduction in accident rates airlines have to be pro-active-that is, look ahead and identify potential accidents so they can be stopped before they happen. Analysis of FDR data can indicate adverse trends creeping in, which can be monitored and preventive action can be taken before a chronic breakdown of vital systems occur. Continuous analysis of the DFDR, combined with FOQA helps promote trend analysis, knowledge building, and decision-making that will improve airline safety & savings in operations cost.

SAFE can be developed for any airline on a turnkey basis and customised for any type of aircraft fitted with FDR to suit individual airlines monitoring requirements. SAFE has fully specified, coded and tested analysis routines. Flight data is recorded in the FDR during flight and then downloaded using an interface card onto a ground station computer. This data in conjunction with SAFE software helps determine various aspects of the flight.

The data can be printed or viewed graphically or numerically. Regardless of the type of view the user selects, the analysis of exceedance will show warning and extreme values. The statistical capability of SAFE to extract and provide valuable information in pie-chart, bar-chart, or tabular format is useful even for a non-technical executive to understand. The user can visualise the flight by reconstructing the flight path and the corresponding display on the instrument during various phases of flight.

On-line help facility is available to the user at every stage. Versatile report generation facility enables report generation as per users' requirement. SAFE software is an open-ended design allowing for further expandability as and when new developments take place, thus saving costs for the user.

Point of Contact: Veesem Raytech Aerospace web site, http://www.vsmaerospace.com

Comments: SAFE is now successfully being used by India's number one domestic airline, Jet Airways. In the past three and a half months Jet Airways have analysed 155 flights daily and clocked a total of over 21,000 flights and are fully satisfied.

HUMAN FACTORS ANALYSIS

Title: Aircrew Incident Reporting System (AIRS)

Information Source: "Incident Investigation and Analysis for E&P Operations": Matthias Schmidlin's presentation at the Third GAIN World Conference, http://www.gainweb.org/GAIN3agenda.html

Purpose: To improve the understanding and handling of human factors issues internally at airlines.

Description: – AIRS is a confidential human factors reporting system that is offered primarily to Airbus customers. It provides airlines with the necessary tools to set up an in-house human performance system. The main categories are crew behaviour and contributory factors. It is compatible with BASIS which simplifies the transmission of data, and reduces time and effort requirements.

AIRS was established to better understand the man-machine (human factor) events that occur with aircraft. It aims to encourage operators to establish their own Confidential Reporting System for such events, and at a later stage share the data with Airbus Industrie. The objective of the process is to collect and analyse non-technical data to understand the latent or systemic conditions as well as the behavioural aspects of operational events. AIRS aims to provide an answer to "what" happened as well to "why" a certain incident occurred.

The analysis is essentially based on a causal factor analysis, structured around the incorporated taxonomy. The taxonomy is similar to the SHEL model structured around Environmental, Informational, Personal, and Organisational factors which may have had an influence on crew actions. The coding process is done for positive as well as negative factors, distinguished by different colour-coding. AIRS is based on a human factors database that associates crew actions with over 20 humans factors-related cause-and-effect factors. AIRS is the idea of external and internal sharing of information. The data is a provision of results, not raw data.

Point of Contact: Matthias Schmidlin, 33 561 93 33 31, Matthias.Schmidlin@Airbus.fr

Comments:

HUMAN FACTORS ANALYSIS

Title: Computer-Assisted Debriefing System (CADS)

Information Source: Flight Data Company web site, http://www.spirent-systems.com/fdc/cads.htm, Captain J.W. Buckner's presentation at the Third GAIN World Conference, November, 1998, Long Beach, CA.

Purpose: To provide a link for establishment and reinforcement of flight/CRM skills and to be a training device to check procedures.

Description: CADS simultaneously records flight data, cockpit video and audio data from a simulator session. Instructors can mark a session for technical and human factors events using hand-held touch screens. The result is a reconstruction of the 'flight'. Instructors can quickly locate and replay marked events, this will help encourage more crew interaction during debriefing. Detailed analysis of the session, outside of the simulator provides feedback for analysis, reflection, and self-discovery.

CADS data is stored in a central processing unit, which can replay the flight immediately for training validation and performance feedback for flight crews. The video recordings capture certain flight/navigation/engine instruments, control positions, tactical displays, in-flight tracking of flight data, and other selected viewpoints. Some of the applications currently used by CADS are crew self-critique and trend analysis. It can be used for curriculum development for task analysis and targeting problem areas. CADS reduces cultural and language barriers by providing visual information, and it also improves inter-rater reliability.

CADS flight information is captured directly from the simulator, and the video and audio from the cockpit are recorded and digitised. CADS can interface with most terrain databases available, and can be configured to support multiple simulators with a minimum of 4 hours recording capability.

Point of Contact: Dr. Jim Blanchard, Embry-Riddle Aeronautical University at Daytona Beach, (904) 226-7037, jwb@db.erau.edu

Comments:

HUMAN FACTORS ANALYSIS

Title: Flight Crew Human Factors Integration Tool

Information Source: "Development of the Flight Crew Human Factors Integration Tool", Phase II Summary Report, G. Gosling, K. Roberts, Nextor Research Report RR-98-10

Purpose: Applies human error models to accident/incident databases in a consistent manner.

Description: The prototype Integration Tool is an Internet (world wide web) based data access and analysis tool that permits safety analysts, accident investigators, human factors professionals, and others to remotely apply two human error models to the NTSB accident/incident and FAA National Airspace Incident Monitoring System (NAIMS)/Pilot Deviation System (PDS) incident databases in a consistent manner. For the NTSB database, the prototype IT produces a cross-tabulation matrix of Type of flight Crew Error (e.g. slips and mistakes) and the Domain of Flight Crew Error (e.g. aircraft system and weather conditions) during which the error occurred. For the PDS database, the prototype IT produces a matrix of Type of Flight Crew Error and year of the PDS event. For each database-model pair selected the IT will generate a Master Matrix. The user can then create sub-matrices from the master matrix by selecting any combination of year, weather condition, airspace user, aircraft manufacturer (make), phase of flight, and pilot's total hours flown.

Point of Contact: Jack Wojciech, Office of System Safety, Federal Aviation Administration, Washington, DC,202-267-9108, jack.wojciech@faa.gov

Comments:

HUMAN FACTORS ANALYSIS

Title: Human Factor Analysis and Classification System

Information Source: U.S. Navy Safety Center Homepage
http://www.safetycenter.navy.mil/aviation/presentations.htm

Purpose: To identify system failures to better understand their roles in incidents/accidents, and to detect their presence and correct them before an incident or accident occurs.

Description: In the U.S. Navy, accident rates (per 100,000 flight hours) for human causes continue to dominate rates due to mechanical causes for the past two decades, through mechanical and human factors rates declined until 1989. HF rates increased in the early 90s and led to adoption of the Reason Model (1990) as an explanation of all sources of human accident causes. The first layer of defence is against unsafe acts (active conditions). The second layer is against preconditions for unsafe acts (latent conditions). Latent conditions extend to unsafe supervision, and finally organisational factors. This presentation describes a human factors classifications system developed for naval aviation use employing the Reason Model.

Five criteria were used throughout the development process of HFACS: comprehensiveness, diagnosticity, reliability, usability, and validity. Where comprehensiveness is concerned, the framework has proven itself to presenting a taxonomy that is robust and complete in its error categories with regard to the types of errors that occur in various operational settings. With regard to diagnosticity, the framework has been found to be an effective tool, having utility as both an error analysis and intervention assessment tool. Reliability analyses have been continually performed as the framework has been expanded to capture additional human factors issues or applied to other types of aviation accidents, such as commercial and general aviation accidents. Evidence of the frameworks usability is that large organisations the U.S. Navy/Marine Corps and the U.S. Army have adopted HFACS as an accident investigation and data analysis tool. HFACS is also currently being used within other organisations such as the FAA and NASA as a supplement to pre-existing systems. The concept of validity concerns what a taxonomy captures or measures, and how well it does so. Three types of validity are discussed (content, face, and construct validity). The construct validity refers to the extent to which the framework taps into the underlying causes of errors and accidents. The framework encompasses the multiple aspects of human error, including the conditions of operators and organisational failure.

Point of Contact: U.S. Navy Safety Center Homepage
www.safetycenter.navy.mil/aviation/presentations

Comments:

HUMAN FACTORS ANALYSIS

Title: Procedural Event Analysis Tool (PEAT)

Information Source: Boeing web site, http://www.boeing.com

Purpose: To identify the key underlying cognitive factors that contribute to procedural non-compliance, and to help the airline industry manage safety risks associated with flight crew procedural deviations.

Description: PEAT was designed to significantly change how incident investigations are conducted. The PEAT process focuses on a cognitive approach to understand how and why the event occurred, not who was responsible. PEAT depends on an investigative philosophy which acknowledges that professional flight crews very rarely fail to comply with a procedure intentionally, especially if it is likely to result in an increased safety risk. It also requires the airline to explicitly adopt a non-jeopardy approach to incident investigation. PEAT contains more than 200 analysis elements that enable the safety officer to conduct an in-depth investigation, summarise findings and integrate them across various events. PEAT also enables operators to track their progress in addressing the issues revealed by the analyses.

PEAT is made up of three components: a process, data storage, and analysis. It provides an in-depth structured analytic process that consists of a sequence of steps that guide the safety officer through the identification of key contributing factors and the development of effective recommendations aimed at the elimination of similar errors in the future. The data are then entered into a database application for future trend analysis. Although designed as a structured tool, PEAT also provides the flexibility to allow for the capture and analysis of narrative information as needed.

PEAT provides consistency in application and results. The PEAT form, which is intended to be used by a trained Safety officer, is designed to facilitate the investigation of specific types of incidents. Therefore, it addresses all the pertinent analysis elements.

Point of Contact: Mike Moodi, Boeing Corp. Flight Technical Services, http://www.boeing.com/news/techissues/peat/index.htm

Comments:

HUMAN FACTORS ANALYSIS

Title: Reason Model, Bayesian Network

Information Source: ISASI Safety Resource Centre web site
http://www.awgnet.com/safety/library/isaslux.htm

Purpose: Probability theory to construct expert systems for fault diagnosis.

Description: A Bayesian network Reason model is a directed acyclic (unidirectional) graph formed by a set of variables and directed links between variables. Each variable represents an event and has countable or continuous states. The network is analogous to an influence diagram in which the causal impacts between events are connected by arrows. The certainty of each state is described by its probability of occurrence and the relations between events are described by conditional probabilities. The change of the certainty of an event affects the certainty of other events. When evidence enters the network, the certainty of events can be obtained by propagating the evidence. Therefore, Bayesian networks create a very useful language in building models of domains with inherent uncertainty. The probabilities of events provided by the network model are used to support the decision making. Model-based expert systems incorporate causal knowledge by including a representation of a system's structure, function, and behaviour.

Point of Contact: Dr. James Luxhoj - Rutgers University, 732-545-4671
jluxhoj@rci.rutgers.edu

Comments:

HUMAN FACTORS ANALYSIS

Title: Integrated Process for Investigating Human Factors

Information Source: "An Integrated Process for Investigating Human Factors," Report by the Human Performance Division, Transportation Safety Board of Canada

Purpose: Human factors analysis

Description: This process provides a step-by-step systematic approach in the investigation of human factors. The process is an integration and adaptation of a number of human factors frameworks: SHEL, Reason's Accident Causation and generic error modelling frameworks and Rasumssen's . The process can be applied to both types of occurrences – accidents and incidents. The process consists of seven steps" 1) collect occurrence data, 2) determine occurrence sequence, 3) identify unsafe actions (decisions) and unsafe conditions, and then for each unsafe act (decision) 4) identify the error type or adaptation, 5) identify the failure mode, 6) identify behavioural antecedents, and 7) identify potential safety problems.

Point of Contact: Maury Hill - Transportation Safety Board of Canada
Maury.Hill@bst.gc.ca

Comments:

HUMAN FACTORS ANALYSIS

Title: Reason Model

Information Source: "Too little and too late: A commentary on accident and incident reporting systems", Reason J., Near Miss As a Safety Tool, T.W. Van der Schaaf, Lucas D. A., Hale A R., Butterworth-Heineman Ltd., Oxford, 1991, 9-25.

Purpose: It describes tools and techniques for managing risks of organisational accidents that go beyond those currently available to system managers and safety professionals. It deals with prevention of major accidents arising from human and organisational causes in many different domains.

Description: It is proposed that while incident and accident reporting systems are a necessary part of any safety information system, they are, by themselves, insufficient to support effective safety management. In order to promote proactive accident prevention rather than reactive "local repairs", it is necessary to monitor an organisation's "vital signs" on a regular basis. "Types" and "Tokens" as classes of human failure are described and their difference is highlighted. The nature of the onward mappings between the type-token elements and the "accident causation model" is described. Two "faces" of the organisation's safety, the harsh face and the positive but largely concealed face, are explained. A notional "safety space" is introduced. Five information system channels that together comprise the safety information system are described.

Point of Contact: Dr. James Reason, University of Manchester (UK), james.reason@man.ac.uk, 44-161-275-2000 (Univ. central operator).

Comments:

HUMAN FACTORS ANALYSIS

Title: Techniques for Human Error Rate Prediction (THERP)

Information Source: Handbook of Industrial Engineering, Chapter 38, "Human Reliability" K.S. Park, Professor at Department of Industrial Engineering, Korea Advanced Institute of Science and Technology, Cheongryang, Seoul, Korea. Two articles authored by A.Swain, from Sandia National Labs. Swain, A., A Method for Performing a Human Factors Reliability Analysis, Monograph SRC-685, Sandia National Labs, 1963. Swain, A., and Gutterman, H., Handbook of Human Reliability Analysis, U.S. NRC Technical Report, NUREG/CR-1278, 1983. ***Gutterman and Swain no longer work for Sandia

Purpose: To predict human error probabilities in human reliability analysis.

Description: THERP is a predictive technique for human error probabilities (HEP) in human reliability analysis. The term probability really means error rate: errors per opportunity. THERP models events as sequences of binary decision branches. At each node, a task is done either correctly or incorrectly. Once the event tree is constructed and the estimates of the conditional probabilities of success or failure are assigned to each limb, the probability of each path through the tree may be calculated. There are HEP data banks that provide "nominal" data for THERP. Then task-specific behavioural factors such as stress, skill-level, administrative and engineering controls are taken into account to modify the nominal HEPs. THERP outputs can be used in engineering and PRA studies.

Point of Contact: Sandia National Laboratories web-site, http://www.ca.sandia.gov

Comments:

HUMAN FACTORS ANALYSIS

<u>Title</u>: Maintenance Error Decision Aid (MEDA)

<u>Information Source</u>: GAIN web-site,
http://www.gainweb.org/Conferences/GAIN3/GAIN3agenda.html

<u>Purpose</u>: To identify sources of maintenance error.

<u>Description</u>: MEDA is an analysis tool developed by Goodyear Aerospace to help document and understand root causes of human errors in aviation maintenance. The maintenance worker uses a computer screen to characterise the nature of the maintenance error. With a build-up of such records, various analysis can be conducted including root
cause and human factor analysis.

<u>Point of Contact</u>: Dr. William Rankin, Associate Technical Fellow, Boeing, P.O. Box 3707, MC 2J-56, Seattle, WA 98124-2207, Tel: (206) 544-8733, FAX: (206) 544-8502, william.l.rankin@boeing.com

<u>Comments</u>: MEDA has partnered with some airlines.

OCCURRENCE INVESTIGATION AND ANALYSIS

Title: TapRooT

Information Source: TapRooT software brochure, TapRooT web site http://www.systemsapproach.com/sasframeset1.html

Purpose: Guide the accident/incident investigation process by helping collect information about the incident, find root causes, provide a standard incident report, trend incident information, and track corrective action.

Description: The TapRooT System process and techniques are packaged in a computerised tool that helps investigators focus on what happened and why it happened, and help investigators find the real, fixable root causes of accidents, incidents, near-misses, quality and productivity problems. Although it was not specifically designed for aviation, TapRooT can be applied to an airline's safety program. This tool builds on the Root Cause Tree with an interface that helps an investigator use the tree more consistently for root cause analysis. TapRooT is a complete incident investigation database that includes customisable fields so the user can add information that they think is important. It has five standard reports which include: a standard incident report with customisable fields, a TapRooT Root Cause Tree graphical report marked-up wit a record of the root cause analysis, a Corrective Action Matrix, a corrective action tracking report with several reporting options, and a root cause analysis comment report. Drawing an Events & Causal Factors Chart (E&CF) is an essential part of the TapRooT process for finding root causes. When the user enters the corrective actions they are automatically entered into their standard report and into the corrective action tracking database. The database links the corrective action to the corresponding root cause. The database tracks the corrective action, the person responsible, and the due date. The user can print reports of what's complete, what's outstanding, and what's overdue.

Point of Contact: Systems Approach Strategies, (905) 430-8744

Comments: Aviation-related companies currently using TapRooT could not be identified. However, the web site has several success stories from mining, fuel, and telecommunications companies who have had success with this tool.

OCCURRENCE INVESTIGATION AND ANALYSIS

Title: The Integrated Safety Investigation Methodology (ISIM)

Information Source: Transportation Safety Board of Canada

Purpose: The Integrated Safety Investigation Methodology (ISIM) is a detailed methodology to support the investigation of transportation occurrences

Description: ISIM was developed by the Transportation Safety Board of Canada to implement a standardised and comprehensive methodology to support the investigation/analysis of multi-modal occurrences in the transportation sector. It focuses on the identification of safety deficiencies. ISIM integrates the identification of safety deficiencies, with the analysis and validation of those deficiencies. The prime components of ISIM are: occurrence assessment; data collection; events and factors diagramming; use of the TSB's existing integrated investigation process to uncover the underlying factors (safety deficiencies); risk assessment; defence/barrier analysis; risk control options; and safety communications. Plans are being made to automate parts of the methodology and tie it more closely to the TSB's modal database systems.

Point of Contact: Maury Hill - Transportation Safety Board of Canada, Maury.Hill@bst.gc.ca

Comments:

OCCURRENCE INVESTIGATION AND ANALYSIS

Title: Integrated Process for Investigating Human Factors *(Also under Human Factors)*

Information Source: "An Integrated Process for Investigating Human Factors," Report by the Human Performance Division, Transportation Safety Board of Canada

Purpose: Human factors analysis

Description: This process provides a step-by-step systematic approach in the investigation of human factors. The process is an integration and adaptation of a number of human factors frameworks: SHEL, Reason's Accident Causation and generic error modelling frameworks and Rasumssen's . The process can be applied to both types of occurrences – accidents and incidents. The process consists of seven steps" 1) collect occurrence data, 2) determine occurrence sequence, 3) identify unsafe actions (decisions) and unsafe conditions, and then for each unsafe act (decision) 4) identify the error type or adaptation, 5) identify the failure mode, 6) identify behavioural antecedents, and 7) identify potential safety problems.

Point of Contact: Maury Hill - Transportation Safety Board of Canada, Maury.Hill@bst.gc.ca

Comments:

OCCURRENCE INVESTIGATION AND ANALYSIS

Title: Multilinear Events Sequencing (MES)

Information Source: Modern Accident Investigation and Analysis, 2nd Edition, Ted S. Ferry, Wiley Interscience, 1998.

Purpose: Accident Causal Factor/Chain Structure Analysis

Description: MES is a method of diagramming (flowcharting) sequences of events that may occur in series or parallel, leading to a mishap. It's distinguishing feature is that it orders events on a time-line basis. It is used for mishap investigation, especially those involving hazard cargoes, by the NTSB. It is based on the theory that knowledge of the timing of when the mishap began, how it unfolded, and when it ended is critical to determining who and what was involved, hence for corrective action. Furthermore, it assumes a mishap begins with an initiating event, when a stable situation is disturbed. An accepted approach has been to look for causal factors up to 72 hours before the event. In the MES process, the investigator must account for each action of every actor who (or which) brought about a change of state in the sequence. Events are posted in a strict sequence, left to right. Conditions (wet runway) are shown where they act to create the next event, in conjunction with earlier events(s).

Point of Contact: John Dalton, john.c.dalton@boeing.com

Comments:

OCCURRENCE INVESTIGATION AND ANALYSIS

Title: Sequential Procedures Timed Events Plotting (STEP)

Information Source: University of Alabama Database

Purpose: Technique of "events and causal factors charting," a specialised method of multilinear events sequencing. Methodology (status: currently used) - accident causal factor/chain structure.

Description: Starting with the "ending states" of things and people involved in an accident, you must work backward to reconstruct how that state came to be. As you document the end-state, you should separate actors from reactors, and changes that occurred after the "last harmful event" from those that occurred during the accident sequence. You must interview people, and obtain information. Things, both stressors and stresses, can also be data sources, although they are used less often that people. You are looking for actions that initiated other actions as well as their sequence, timing, and effect. The STEP worksheet serves as a specially structured, dynamic file for the events data acquired during an investigation. Each blode must go in the proper actor row and in the column that corresponds to the correct sequence of that action in relation to other actions, by that actor or other actors.

Point of Contact: Modern Accident Investigation and Analysis, 2nd Edition, Ted S. Ferry, Wiley Interscience, 1988.

Comments: Data Source: Accident records

SAFETY RISK ANALYSIS

Title: @Risk

Information Source: @Risk Advanced Risk Analysis for Spreadsheets, Palisade Corporation, 1996.

Purpose: Provides risk analysis and simulation add-ins for spreadsheet models. @Risk is a risk analysis and simulation add-in (software tool) for Microsoft Excel or Lotus 1-2-3. @Risk recalculates spreadsheet hundreds of times, each time selecting random numbers from the @Risk functions entered. This not only tells what could happen in a given situation, but how likely it is that it will happen. It is a quantitative method that seeks to determine the outcomes of a decision as a probability distribution. The techniques in an @Risk analysis encompass four steps: (1) Developing a Model – by defining problem or situation in Excel or 123 worksheet format, (2) Identifying Uncertainty – in variables in Excel or 123 worksheet and specifying their possible values with probability distributions, and identifying the uncertain worksheet results that are to be analysed, (3) Analysing the Model with Simulation – to determine the range and probabilities of all possible outcomes for the results of the worksheet, and (4) Making a Decision – based on the results provided and personal preferences @Risk helps with the first three steps by providing a powerful and flexible tool that works with Excel or 123 to facilitate model building and Risk Analysis. The results that @Risk generates can then be used by the decision-maker to help choose a course of action. @Risk uses the techniques of Monte Carlo simulation for risk analysis. In @Risk, probability distributions are entered directly into worksheet formulas using custom distribution functions, such as Normal Beta. Each iteration, the spreadsheet is recalculated with a new set of sample value and a new possible results is generated for output cells, and new possible outcomes are generated each iteration. Advanced analysis in @Risk allows sophisticated analysis of simulation data. Sensitivity analysis, which identifies significant inputs, is carried out with two different analytical techniques. Scenario analysis identifies of combinations or inputs that lead to output target values. It attempts to identify groupings of inputs that cause output values.

Point of Contact: Palisade Corporation web site, http://www.palisade.com/

Comments:

SAFETY RISK ANALYSIS

Title: FaultrEASE

Information Source: FaultrEASE User's Manual, Version 2.0, May 1996

Purpose: Facilitates creation, calculation, and display of fault trees.

Description: FaultrEASE allows the user to create, edit, and draw fault trees with minimal effort. It performs elementary fault tree mathematics, including mixed probability and frequency calculations, Boolean reduction, and cut sets. When drawing trees with FaultrEASE the user only need be concerned with the tree's content, as its form is adjusted automatically. After each edit is made, FaultrEASE will balance the tree, centre labels, and place statistics, transfers and tags. FaultrEASE also simplifies fault tree editing with the use of cells. A cell is a rectangular region that contains the graphical representation of an event. An event is defined as an atomic unit of fault tree construction, consisting of either a gate or a leaf. Gates logically consist of both the gate symbol itself and the box above it. In FaultrEASE both parts share a single cell. The result is that any tree built with FaultrEASE will always be a proper tree--it is impossible to violate the "no gate-to-gate" rule. The user can save the work to a file, and retrieve it later. The file contains descriptions of the symbols in the fault tree, as well as the values of all changeable parameters. When the user loads the next tree, all of these parameters will be set to the values set for that tree.

Point of Contact: Gregory Wilcox, Arthur D. Little, Inc., 617-498-5476, wilcox.g@adlittle.com

Comments: *(It would be nice to have some discussion geared toward aviation safety analysis—how is this tool helpful, how does it make the job of the safety analyst easier, what specific aviation safety functions does it support for the airline flight safety officer, etc.)*

SAFETY RISK ANALYSIS

Title: Fault Tree Analysis (FTA)

Information Source: System Safety Engineering and Risk Assessment: A Practical Approach, Nicholas J. Bar, Taylor & Francis, Washington, D.C., 1997.

Purpose: Assess a system by identifying a postulated undesirable end event and examining the range of potential events that could lead to that state or condition.

Description: Fault tree analysis is a graphical method commonly used in reliability engineering and systems safety engineering. It is a deductive approach that documents qualitatively the potential causal chains leading to a top (head) event, but it also accommodates quantitative analysis when probability or "rate" information is adjoined to the graphical tool. Starting with the top event (typically undesirable), the safety engineer goes through causal chains systematically, listing the various sequential and parallel events or combinations of failures that must occur for the undesired top event to occur. Logic gates (AND, OR) and standard Boolean algebra allow the engineer to quantify the fault tree with event probabilities, and lead to the probability (or rate) of the top event. Not all system or component failures are listed, only the ones leading to the top event. Only credible faults are assessed, but may include hardware, software, human failures and/or environmental conditions.

Point of Contact: Dr. James Luxhoj - Rutgers University, 732-545-4671
jluxhoj@rci.rutgers.edu

Comments: The technique is universally applicable to systems of all kinds, with the following ground rules: (1) Events that are to be analysed/abated, and their contributors, must be foreseen. (2) Each of those system events must be analysed individually. Primary limitations of the technique are: (1) The presumption that relevant events have been identified. (2) The presumption that contributing factors have been adequately identified and explored in sufficient depth. Apart from these limitations, the technique as usually practised is regarded as among the most thorough of those prevalent for general system application. Significant training and experience is necessary to use this technique properly. Application, though time-consuming, is not difficult once the technique has been mastered. Computer aids are available and are increasingly used.

SAFETY RISK ANALYSIS

Title: Event Tree Analysis (See also Fault Tree Analysis and Network Logic Analysis)

Information Source: System Safety Analysis Handbook, System Safety Society, No.26 P3-93 2nd Edition, July 1997

Purpose: Organise, characterise, and quantify potential accidents in a methodical manner by modelling the sequence of events that results from a single initiating event.

Description: Select initiating events, both desired and undesired, and develop their consequences through consideration of system/component failure-and-success alternatives. Identification of initiating events may be based on review of the system design and operation, the results of another analysis such as a Failure Modes and Event Analysis, a Hazardous Operation Analysis, etc., or personal operating experience acquired at a similar facility. Postulate the success or failure of the mitigating systems and continue through all alternate paths, considering each consequence as a new initiating event.

Point of Contact: Simon Rose, Oak Ridge National Laboratory, (423) 574-9494, sdr@ornl.gov

Comments: The technique is universally applicable to systems of all kinds, with the limitation unwanted events (as well as wanted events) must be anticipated to produce meaningful analytical results. Successful application to complex systems cannot be undertaken without formal study over a period of several days to several weeks, combined with some practical experience. Methodology is enormously time consuming and, therefore, should be reserved for systems wherein risks are thought to be high and well concealed (i.e., not amenable to analysis by simpler methods).
Additional Reference: Lewis, H.W., “The Safety of Fission Reactors”, “Scientific American, Vol. 242, No. 3, March 1980.

SAFETY RISK ANALYSIS

<u>Title</u>: Flight Operations Risk Assessment System (FORAS)

<u>Information Source</u>: Sandia National Laboratories April 1999 report, by ERAU, NCAR, and NRL

<u>Purpose</u>: To provide a quantitative assessment of selected risks associated with flight operations.

<u>Description</u>: This is a decision support tool for safety managers to measure, monitor, and reduce exposure to major accident/incident risks. It is an expert system to recommend interventions to reduce accident/incident risk for individual flights. FORAS is a proactive approach and includes risk categories for initial phases and identification of risk attributes for CFIT and turbulence. The preliminary model for the FORAS project is a hierarchical structure of attributes and a technique for eliciting expert input. FORAS current activities include: developing a weather and forecast database to generate inputs for the weather-related attributes in the CFIT risk model, a partnership with UAL to generate prototype, to conduct systems analysis to determine the user requirements for an airline partner, obtain airline-specific data to generate inputs for CFIT risk model, develop software to implement mathematical models for risk categories, and validate and test model in a partner airline.

<u>Point of Contact</u>: Jack Wojciech, 202-267-9108, jack.wojciech@faa.gov

<u>Comments</u>:

SAFETY RISK ANALYSIS

Title: Probabilistic Risk Assessment (PRA)

Information Source: Risk Assessment and Risk Assessment Methods: The State-of-the-Art, NSF/PRA-84016, January 1985

Purpose: It quantifies the probabilities and consequences associated with accidents and malfunctions by applying probability and statistical techniques as well as various consequence evaluation methods.

Description: Probabilistic Risk Assessment (PRA) data inputs included actuarial events in combination with logic models to predict frequencies and consequences of events which have not happened but which could cause accidents. Modern PRA embraces event/fault tree analysis, computer models, reliability theory, systems analysis, human factors analysis, probability theory, and statistics. These and the appropriate engineering disciplines are integrated into a formal process that addresses the two components of risk: likelihood and consequences.

Point of Contact: Dr. James Luxhoj - Rutgers University, 732-545-4671
jluxhoj@rci.rutgers.edu

Comments:

SAFETY RISK ANALYSIS

Title: Control Rating Code (CRC) Method

Information Source: System Safety Analysis Handbook, System Safety Society, No.13 P3-47 2nd Edition, July 1997

Purpose: A safety-based procedure used to produce consistent safety effectiveness ratings of candidate actions intended to control hazards found during system safety analyses or accident investigations.

Description: The CRC method is a generally applicable system safety-based procedure used to produce consistent safety effectiveness ratings of candidate actions intended to control hazards found during system safety analyses or accident investigations. Its primary purpose is to control recommendation quality. A secondary purpose is to require systematic application of accepted safety principles to identification and selection of hazard controls intended to control system risks. Finally, it helps analysts identify priorities to support specific hazard control action plans. To use CRC method, the analyst must first define the safety problems which create a hazard, estimate the relative risk level for each hazard, and identify options to control the risk posed by the hazard.

Point of Contact:

Comments: Use CRC's to develop relative safety effectiveness ratings for alternative actions proposed to reduce risks. The procedure provides analysts a rationale for supporting or arguing against proposed actions to control hazards. Requires knowledge of system safety and risk assessment concepts, principles, and procedures. A difficulty in the application of CRC's is the lack of demand for recommendation process quality control procedures. The procedures are not valued in organisations that do not demand use of proven safety principles.

SAFETY RISK ANALYSIS

Title: Fleet Risk Exposure Analysis (ARP 5150)

Information Source: Safety Assessment of Transport Aeroplanes in Commercial Service

Purpose: To compare the number of undesired events by type in a fleet of aircraft.

Description: This analysis uses statistical probability to determine the expected number of undesired events of a specific type in a given fleet, based on the predicted or historical event or malfunction rate per flight, and the actual or expected number of fleet operations (exposure).

Point of Contact: Lee Nguyen, FAA Certification Office (202) 267-9937, lee.nguyen@faa.gov

Comments:

SAFETY RISK ANALYSIS

Title: An Approach to Aircraft Performance Risk Assessment Model

Information Source: Rannoch Corporation web site, http://www.rannoch.com

Purpose: The development of a set of software tools which will use recorded aircraft performance data and automatically assess the safety or accident risk associated with aircraft approach and landing operations.

Description: The methodology is intended to be applied to other aircraft operations, but the initial scope was limited to approach and landing to make best use of resources. The initial accident risk analysis was also limited in scope to two types of aircraft accidents-loss of control and controlled flight into terrain. Much of the research effort was directed at flight data management and reduction to arrive at a methodology that would be practical to implement and would require a subset of all aircraft data as input to the model. A section of the report discusses the general development approach taken for this modelling effort, including a review of the data available directly from the aircraft recorder as well as from contextual factors. A discussion of the consequences and associated severity is provided and different statistical modelling techniques are evaluated, along with the rationale for the selected approach. There is also a discussion about how the model can be used to perform causal analysis.

Point of Contact: Rannoch Corporation, 703-838-9780

Comments:

TRENDANALYSIS

Title: Statgraphics Plus *(Also under Descriptive Statistics)*

Information Source: Statgraphics Plus, User Manual, Version 6

Purpose: To retrieve information contained in a set of data and determine a relationship between different sets of data.

Description: Statgraphics Plus has more than 200 powerful statistical analyses to choose from and a host of innovative features. It has different screens to guide the user through every statistical analysis or graphics choice they make. It has the look and feel of Microsoft Windows, and is compatible with Windows NT, Windows 98, or Windows 95. Statgraphics Plus allows access to graphics in every procedure. It offers three different packages: Statgraphics Plus Standard Edition, Statgraphics Plus Quality and Design, and Statgraphics Plus Professional. The features involved are system, graphic, Design of Experiments, Quality Control, Life Data Analysis, and Other Analysis and Plots. With features like StatAdvisor give the user instant interpretations of results; StatFolio is a revolutionary new way to automatically save and reuse analyses; truly interactive graphics; StatGallery, letting the user combine multiple text and graphics panes on multiple pages; StatWizard guides the user through a selection of data and analyses; StatReporter allows the user to publish reports from within Statgraphics Plus; StatLink allows the user to poll data at user-specified intervals; Statgraphics Plus Professional gives the user all of the functionality found in the Quality and Design configuration plus analyses for time-series, multivariate methods, and advanced regression.

Point of Contact: StatGraphics Plus web site **http://www.statgraphics.com/html/prod03.html**

Comments:

TRENDANALYSIS

Title: Microsoft Excel *(Also under Descriptive Statistics)*

Information Source: Microsoft Office Product Guide

Purpose: To develop equations, results, charts, and tables for data.

Description: Microsoft Excel allows the user to analyse, report, and share their data. It has formula creation and natural language formulas that let the user build equations using their own terminology instead of cell co-ordinates. Formula AutoCorrect fixes common equation errors. Microsoft Excel provides a set of data analysis tools called the Analysis ToolPak that a person can use to save steps when developing complex statistical or engineering analyses. The appropriate statistical or engineering macro function displays the results in an output table. The statistics feature includes: linear best-fit trend, exponential growth trend, FORECAST function, fit a straight trend line by using the TREND function, fit exponential curve by using the GROWTH function, plot a straight line from existing data by using the LINEST function, plot an exponential curve from existing data by using the LOGEST function, and a Descriptive Statistics analysis tool. The ChartWizard consolidates chart building and formatting into one place. Microsoft Excel has features that include a range finder, conditional formatting, and allows access to URL's in formulas.

Point of Contact: Microsoft Office Web Site
http://www.microsoft.com/office/archive/x197brch/default.htm

Comments:

TREND ANALYSIS

Title: Characterisation/Trend/Threshold Analysis

Information Source: Jack Wojciech (202) 267-9108

Purpose: To be a rigorous methodology to analyse non-technical operational incidents.

Description: A multi-layered protocol (involving the front-line operator, the airline, the manufacturer, and the CAA) was established to ensure that relevant information is sent to participating organisations in a timely manner, confidentiality and a feedback system are present, prioritisation strategies exist, and keywords and safety principles had a common criteria. This model identifies the safety principles and develops a number and quality of reports. This method when employed properly can assist in identifying trends, outliers, and signal changes in performance. It is used for safety, maintenance, and manufacturing production applications. It is also employed to some extent by the FAA in reporting on general performance by commercial airlines in preparing its "air travel consumer report" on flight delays, mishandled baggage, oversales, etc. It is based on well-established methodologies. For use in analysing infrequent events, there are additional adaptations of this approach to handle these cases. In these cases, users need to ensure that in making these applications that they have an experienced statistician working with them. This method is widely used particularly for analysis of events, equipment failure/reliability/maintainability, human performance, process systems performance, etc. This method is used to first characterise data, trend it over time to establish a baseline, and then by expert judgement or statistical inference establishing thresholds or control points that when exceeded indicate a significant change in the performance of what is being monitored. The change is not necessarily bad or undesirable. Once the change is reflected through this process, then it is incumbent upon the responsible party to understand what is driving the change and take corrective action if warranted.

Point of Contact: Jean Paries 33-148-62-62-04, pariesj@worldnet.fr

Comments:

TREND ANALYSIS

Title: Trend Analysis, Statistical Process Control, Time Series Analysis

Information Source: Statistical Quality Control, 2nd Edition, Douglas C. Montgomery

Purpose: Analyse trends, statistics, rates, etc.

Description: Any time indexed data can be subjected to a trend analysis, using tools from statistical process control and time-series analysis. If one wants to prove that an accident or factor rate has been stable over time, an SPC chart can verify such stability. If one wants to prove that a particular year, or a particular strata of the data (say one carrier's accident/incident rate) is different than those preceding, again the control limits in SPC give a limit beyond which one can conclude a statistically significant change. If one wants to demonstrate a growth or cyclic pattern in data, then either SPC or time-series models can be used. SPC will detect the condition and time-series models with appropriate parameters will model the pattern and even predict where it is headed.

Point of Contact: Douglas C. Montgomery, (602) 965-3836, doug.montgomery@asu.edu

Comments:

TREND ANALYSIS

Title: Software Analysis for Flight Exceedance (SAFE)

Information Source: Veesem Raytech Aerospace

Purpose: To help in the analysis of FDR data to identify any exceedances that might have occurred and are beyond the user's predefined range of certain parameters.

Description: To help airlines achieve FOQA compliance, Veesem Raytech Aerospace has developed a Windows-based software to analysis FDR data of every flight. Their approach is that in order to obtain a significant reduction in accident rates airlines have to be pro-active-that is, look ahead and identify potential accidents so they can be stopped before they happen. Analysis of FDR data can indicate adverse trends creeping in, which can be monitored and preventive action can be taken before a chronic breakdown of vital systems occur. Continuous analysis of the DFDR, combined with FOQA helps promote trend analysis, knowledge building, and decision-making that will improve airline safety & savings in operations cost.

SAFE can be developed for any airline on a turnkey basis and customised for any type of aircraft fitted with FDR to suit individual airlines monitoring requirements. SAFE has fully specified, coded and tested analysis routines. Flight data is recorded in the FDR during flight and then downloaded using an interface card onto a ground station computer. This data in conjunction with SAFE software helps determine various aspects of the flight.

The data can be printed or viewed graphically or numerically. Regardless of the type of view the user selects, the analysis of exceedance will show warning and extreme values. The statistical capability of SAFE to extract and provide valuable information in pie chart, bar-chart, or tabular format is useful even for a non-technical executive to understand. The user can visualise the flight by reconstructing the flight path and the corresponding display on the instrument during various phases of flight.

On-line help facility is available to the user at every stage. Versatile report generation facility enables report generation as per users' requirement. SAFE software is an open-ended design allowing for further expandability as and when new developments take place, thus saving costs for the user.

Point of Contact: Veesem Raytech Aerospace web site, http://www.vsmaerospace.com

Comments: SAFE is now successfully being used by India's number one domestic airline, Jet Airways. In the past three and a half months Jet Airways have analysed 155 flights daily and clocked a total of over 21,000 flights and are fully satisfied.

APPENDIX D

SAFETY SURVEYS

&

AUDITS

APPENDIX D TABLE OF CONTENTS

This appendix contains samples checklists and surveys. Please tailor these documents to fit your specific organisation.

Safety Surveys

A safety culture survey should be undertaken to 'benchmark' the company safety culture immediately before an Aviation Safety Management System is introduced and again, perhaps 12 months later, to measure the improvements in culture resulting from the use of the system.

The survey, using the questionnaire in this section, will reveal three major facets of the company and how it behaves.

- The difference (if any) in the way managers and workers see the culture
- Targets for resources (any 1 or 2 answers)
- A benchmark to measure any changes to procedures against a later survey.

Airline Safety Culture Index

All employees of an airline, irrespective of the section in that they work, contribute to safety and are each personally responsible for ensuring a positive safety culture. The purpose of this questionnaire is to obtain your opinions about safety within the airline. It would be appreciated if you would answer all of the questions as honestly as possible. Give your own answers, not those of other employees.

You are required to give your name so we can contact you for clarification if necessary but all of your answers will be kept confidential and your reply will be de-identified.

Please complete the following section to best identify your position and job description and indicate your base.

Name ....…

Phone: ....…

Grade (if known)…………………………………………………

Job Title……………………………………………………………….

Work Area…………………………………………………………….

BASE………………………………………………………………….

Please send this cover sheet and the completed questionnaire forms to: XXX

NOTE: This form will be destroyed as soon as data is recorded in the database.

INDIVIDUAL SAFETY SURVEY SAMPLE #1

Circle the appropriate number (I to 5) in its box against each of the 25 questions. If you **strongly disagree** with the statement, **circle 1**. If you **strongly agree, circle 5**. If your opinion is somewhere in between these extremes, **circle 2, 3** or **4** (for **disagree**, **unsure** or **agree**).

Please respond to every question. Adding all the responses gives a safety culture score for the company, which is checked against known benchmarks.

Question Number	STATEMENT	COMPANY RATING				
		Strongly Disagree				Agree
1	Employees are given enough training to do their tasks safely.	1	2	3	4	5
2	Managers get personally involved in safety enhancement activities	1	2	3	4	5
3	There are procedures to follow in the event of an emergency in my work area.	1	2	3	4	5
4	Managers often discuss safety issues with employees.	1	2	3	4	5
5	Employees do all they can to prevent accidents.	1	2	3	4	5
6	Everyone is given sufficient opportunity to make suggestions regarding safety issues	1	2	3	4	5
7	Employees often encourage each other to work safely.	1	2	3	4	5
8	Managers are aware of the main safety problems in the workplace.	1	2	3	4	5
9	All new employees are provided with sufficient safety training before commencing work.	1	2	3	4	5
10	Managers often praise employees they see working safely.	1	2	3	4	5
11	Everyone is kept informed of any changes, which may affect safety.	1	2	3	4	5
12	Employees follow safety rules almost all of the time.	1	2	3	4	5
13	Safety within this company is better than in other airlines.	1	2	3	4	5
14	Managers do all they can to prevent accidents.	1	2	3	4	5
15	Accident investigations attempt to find the real cause of accidents, rather than just blame the people involved.	1	2	3	4	5
16	Managers recognise when employees are working unsafely.	1	2	3	4	5
17	Any defects or hazards that are reported are rectified promptly.	1	2	3	4	5
18	There are mechanisms in place in my work area for me to report safety deficiencies.	1	2	3	4	5
19	Managers stop unsafe operations or activities.	1	2	3	4	5

Question Number	STATEMENT	COMPANY RATING				
		Strongly Disagree				Agree
20	After an accident has occurred, appropriate actions are usually taken to reduce the chance of reoccurrence.	1	2	3	4	5
21	Everyone is given sufficient feedback regarding this company's safety performance.	1	2	3	4	5
22	Managers regard safety to be a very important part of all work activities.	1	2	3	4	5
23	Safety audits are carried out frequently.	1	2	3	4	5
24	Safety within this company is generally well controlled.	1	2	3	4	5
25	Employees usually report any dangerous work practices they see.	1	2	3	4	5
	SAFETY CULTURE TOTAL:					

Notes for Flight Safety Officers

Several separate results are obtained from a safety culture survey using this form:

1. A 'benchmark' safety culture score that can be compared with similar companies world-wide.
2. A means of comparing the views of management with those of staff regarding the Company's safety culture.
3. A means of evaluating the results of any changes made to the company's safety management system when a follow-up survey is carried out.
4. Identification of areas concern, indicated by "1" and "2" responses which can assist in the allocation of safety resources.
5. A means of comparing the safety culture of different departments and/or operational bases.

The higher the value, the better the safety culture rating. Use the following as a guide only but an average company safety culture score of 93 is considered a minimum. Anything less would suggest that improvements are needed.

Poor safety culture	25-58
Bureaucratic safety culture	59-92
Positive safety culture	3-125.

Organisations with a **poor safety culture** treat safety information in the following way:

- Information is hidden
- Messengers are shot
- Responsibility is avoided
- Dissemination is discouraged
- Failure is covered up
- New ideas are crushed

Organisations with a **bureaucratic safety culture** treat safety information in the following way:

- Information may be ignored
- Messengers are tolerated
- Responsibility is compartmentalised
- Dissemination is allowed but discouraged
- Failure leads to local repairs
- New ideas present problems

Organisations with a **positive safety culture** treat safety information in the following way:

- Information is actively sought
- Messengers are trained
- Responsibility is shared
- Dissemination is rewarded
- Failure leads to inquiries and reforms
- New ideas are welcomed

Safety Management System Monitoring

Implementation and Evaluation Checklist

The key elements of a safety management system can be measured and the attached checklist will assist in identifying areas (questions answered 'NO) that must be addressed.

	FACTOR		COMPANY RESPONSE	
MANAGEMENT	1	Is senior management committed to the Aviation Safety Management Program?	Yes	No
	2	Is there a written aviation safety policy, signed by the CEO?	Yes	No
	3	Has a safety manager been appointed?	Yes	No
	4	Is the safety reporting chain appropriate?	Yes	No
	5	Is the Safety Manager sufficiently supported within the organisation?	Yes	No
	6	Is there a Safety Committee?	Yes	No
	7	Is the Safety Manager credible?	Yes	No
	8	Is the Safety Manager an enthusiast for his or her job?	Yes	No
	9	Are the roles and responsibilities of the personnel in the Aviation Safety Management System documented?	Yes	No
	10	Are the values of management identified as being safety oriented?	Yes	No
	11	Are sufficient resources (financial, human, hardware) made available for the Aviation Safety Management System?	Yes	No

	12	Are there appropriate safeguards in place to ensure that the Aviation Safety Management System itself is properly evaluated?	Yes	No
	13	Have appropriate standards been documented?	Yes	No
	14	Is there an appropriate Emergency Response Plan?	Yes	No
HAZARD ASSESSMENT PROCEDURES	15	Is there an effective ongoing hazard identification program?	**YES**	**NO**
	16	Does the hazard identification program include a confidential reporting system?	YES	NO
	17	Are confidential reports properly de-identified?	YES	NO
	18	Are hazards associated with contracted agencies included in the Hazard Reporting System?	YES	NO
	19	Is there a procedure established for acknowledging safety-related reports?	YES	NO
	20	Is there a process whereby the hazards are continuously assessed for their risk potential (likelihood and severity)?	YES	NO
	21	Are the defences against the hazards identified?	YES	NO
	22	Does the process include the identification of the need for further defences or for hazard avoidance?	YES	NO
COMMUNICA-TION WITH MANAGEMENT	23	Is there an effective mechanism by which the Safety Manager or the Safety Committee reports to the CEO and can make recommendations for change or action?	YES	NO
	24	Is there an obligation on the part of the CEO to give formal response to any safety-related recommendations?	YES	NO
	25	In the event that the CEO makes an unfavourable response to a safety recommendation, is there a procedure whereby the matter is monitored by the Safety Manager or Safety Committee until a resolution is reached?	YES	NO
FEEDBACK	26	Are the results of hazard reports and safety suggestions made available to the initiator?	YES	NO
	27	Are the results of hazard reports and safety suggestions made widely available within the Company?	YES	NO
DOCUMENT-ATION	28	Is the process for risk assessment and management fully documented?	YES	NO
	29	Does the Aviation Management System require the recording of identified hazards and defences?	YES	NO
SAFETY-RELATED LITERATURE, COURSES AND SEMINARS	30	Is there a supply of safety-related literature (e.g., periodicals, magazines, books, articles, posters, videos) readily available to all employees who have safety responsibilities?	YES	NO
	31	Are employees encouraged and assisted in attending training courses and seminars related to safety?	YES	NO
	32	Are employees trained in the procedures and policy of the Aviation Safety Management System?	YES	NO

SAFETY INDUCTION AND CONTINUOUS TRAINING	33	Are new employees given sufficient training and checking in their technical duties prior to being permitted to operate either supervised or unsupervised?	YES	NO
	34	Is the continuation of training and checking of all employees adequate?	YES	NO
	35	Are employees given sufficient training in new procedures?	YES	NO
	36	Are trainers and checkers adequately trained and checked, both for competence and standardisation?	YES	NO

INDIVIDUAL SAFETY SURVEY SAMPLE #2

Please answer the following questions.

1. Experience

   Time in Company
   Flight Crew ____ ___0-1 yr ____ 5-9 yr
   Ground Crew ____ ___2-4 yr ____10 or more yrs.

2. Time in present position:

3. What, in your opinion, will cause the next accident? Listed below are some reasons taken from last year’s survey to help you think of an answer for this question. Please consider them and choose the appropriate answer(s). Please explain your choice in a sentence or two.

   a. Complacency
   b. Violation of rules
   c. Mechanical problems/equipment
   d. Pilot/crew error
   e. Fatigue or other physical factors
   f. Working conditions
   g. Procedures on the ground or in the air.
   h. Other

4. What are the shortcomings of our Accident Prevention Program as it now exists'? listed below are some of the reasons taken from last year's survey to help you think of an answer for this question. Please consider them and choose the appropriate answer(s). Please explain your choice in a sentence or two.

   a. Lack of discussion about procedures
   b. Safety publications
   c. Dissemination of information
   d. Standardisation, training
   e. Lack of support or participation
   f. Communications
   g. Suggestions, surveys, etc.
   h. Other

5. What "close call" experiences have you had in the last 6 months?

6. What do you like about the safety program?

7. What ideas, comments or recommendations do you have about improving the safety program in general?

8. When was the last time you had a night training flight?

9. What other comments do you have for me?

10. Are there jobs that you do on a fairly routine basis for which you don't have suitable tools/equipment or you have to "jury rig" gear? Give specifics.

11. Have you received the amount of training you feel you needed to do your job well and safely? What additional training would you have wanted? What additional training do you still want?

12. Are there work routines/schedules that you would like to see changed? How?

13. Are there ground safety hazards on the station that "we live with" or have come to overlook that ought to be corrected? Please name.

14. Are there ground or flight procedures in use, which, in your opinion ought to be changed to enhance safety? Please name.

SAMPLE INDEPENDENT SAFETY PROGRAM AUDIT CHECKLIST

1. Is the supervisor/senior manager involved in the flight safety program and supporting it?

2. Have all parts of the company safety program been implemented in this organisation?

3. Is this organisation getting adequate guidance and assistance from the flight safety office?

4. What training is provided to Flight Safety Officers? Is it adequate?

5. Does Flight Safety Officer have adequate staff?

6. What is the quality, depth and effectiveness of the safety inspection program? Is it doing any good?

7. What is the quality and depth of incident investigations?

8. Are recommendations resulting from accidents and incidents being followed?

9. Is the Hazard Report program effective? Is anyone using it? Is it doing any good?

10. Is flight safety information being distributed to those who need it?

11. Is there a flight safety committee? Is it effective?

12. Is there a plan for accident notification and investigation?

13. Are all reportable incidents being reported and investigated?

14. Do the people in this organisation understand the company safety policy?

15. Do the pilots support the company flight safety program?

16. Are new personnel receiving safety training?

SAMPLE OPERATIONS AUDIT CHECKLIST (INTERNAL)

1. Does this organisation have an appointed Safety Committee member?
2. Are the pilots receiving the safety material that is sent to them?
3. Is there an effective pilot reading file?
4. Are pilots receiving safety information during briefings?
5. Is there a flight safety bulletin board?
6. Are the pilots familiar with the company safety policy and the company flight safety program?
7. Are they using the Hazard Reporting system?
8. Are they aware of recent aircraft accidents?
9. Are they familiar with current company flight safety standards?
10. Do new pilots receive safety orientation and training?
11. Are records of their currency in various types of operations maintained?
12. Does their schedule provide adequate crew rest?
13. Do they have adequate opportunity for meals?
14. Do they have adequate personal equipment?
15. Do they have access to medical personnel?
16. Do they know what to do in case of an accident? (to them or within the company?)
17. Are accident/incident/injury records kept in this organisation?
18. Does this organisation have regular flying safety meetings?
19. Are all company aviation safety standards being met?

Safety Audits

Management and Organisation

Management Structure

i) Does the Company have a formal, written statement of corporate safety policies and objectives?
ii) Are these adequately disseminated throughout the company? Is there visible senior management support for these safety policies?
iii) Does the Company have a flight safety department or a designated flight safety officer?
iv) Is this department or safety officer effective?
v) Does the department/safety officer report directly to senior corporate management, to the CEO or the board of directors?
vi) Does the Company support periodic publication of a safety report or newsletter?
vii) Does the Company distribute safety reports or newsletters from other sources?
viii) Is there a formal system for regular communication of safety information between management and employees?
ix) Are there periodic company-wide safety meetings?
x) Does the Company actively participate in industry safety activities, such as those sponsored by Flight Safety Foundation (FSF), International Air Transport Association (IATA) and others?
xi) Does the Company actively and formally investigate incidents and accidents? Are the results of these investigations disseminated to other managers? To other operating personnel?
xii) Does the Company have a confidential, non-punitive incident-reporting program?
xiii) Does the Company maintain an incident database?
xiv) Is the incident database routinely analysed to determine trends?
xv) Does the Company use outside resources to conduct safety reviews or audits?
xvi) Does the Company actively solicit and encourage input from aircraft manufacturers' product-support groups?

Management and Corporate Stability

i) Have there been significant or frequent changes in ownership or senior management within the past three years?
ii) Have there been significant or frequent changes in the leadership of operational divisions within the company in the past three years?
iii) Have any managers of operational divisions resigned from the company because of disputes about safety matters, operating procedures or practices?

Financial Stability of the Company

i) Has the company recently experienced financial instability, a merger, an acquisition or major reorganisation?
ii) Was explicit consideration given to safety matters during and following the period of instability, merger, acquisition or reorganisation?
iii) Are safety-related technological advances implemented before they are dictated by regulatory requirement, i.e., is the company proactive in using technology to meet safety objectives?

Management Selection and Training

i) Is there a formal management-selection process?
ii) Are there well-defined management-selection criteria?
iii) Is management selected from inside or outside the company?
iv) Is operational background and experience a formal requirement in the selection of management personnel?
v) Are first-line operations managers selected from the most operationally qualified candidates?
vi) Do new management personnel receive formal safety indoctrination or training?
vii) Is there a well-defined career path for operations managers?
viii) Is there a formal process for the annual evaluation of managers?
ix) Is the implementation of safety programs a specific management objective considered in the evaluation?

Work Force

i) Have there been recent layoffs by the Company?
ii) Are a large number of personnel employed on a part-time or contract basis?
iii) Does the Company have formal rules or policies to manage the use of contract personnel?
iv) Is there open communication between employees and management?
v) Is there a formal means of communication among management, the work force and labour unions about safety issues?
vi) Is there a high rate of personnel turnover in operations and maintenance?
vii) Is the overall experience level of operations and maintenance personnel low or declining?
viii) Is the distribution of age or experience level within the Company considered in long-term company plans?
ix) Are the professional skills of candidates for operations and maintenance positions evaluated formally in an operational environment during the selection process?
x) Are multicultural processes and issues considered during employee selection and training?
xi) Is special attention given to safety issues during periods of labour-management disagreements or disputes?
xii) Are the safety implications of deteriorating morale considered during the planning and implementation of reduction in work force or other destabilising actions?
xiii) Have there been recent major changes in wages or work rules?
xiv) Does the Company have a Company-wide employee health maintenance program that includes annual medical examinations?
xv) Does the Company have an employee-assistance program that includes treatment for drug and alcohol abuse?

Fleet Stability and Standardisation

i) Is there a Company policy concerning cockpit standardisation within the company's fleet?
ii) Do pilots/flight-operations personnel participate in fleet-acquisition decisions?

Relationship with the Regulatory Authority

i) Are Company safety standards set primarily by the company or by the appropriate regulatory authority?
ii) Does the Company set higher safety standards than those required by the regulatory authority?

iii) Do the Company's safety standards meet or exceed U.S. Federal Aviation Regulations (FARs)/European Joint Aviation Requirements (JARs) criteria?
iv) Does the Company have a constructive, co-operative relationship with the regulatory authority?
v) Has the Company been subject to recent safety-enforcement action by the regulatory authority?
vi) Does the regulatory authority refuse to recognise the licenses issued by some other countries?
vii) Does the Company evaluate the licensing requirements of other countries when deciding whether to hire personnel who hold licenses issued by those countries?
viii) Does the Company consider the differing experience levels and other licensing standards of other countries when reviewing applications for employment?
ix) Does the regulatory authority routinely evaluate the Company's compliance with required safety standards?

Operations Specifications

i) Does the Company have formal flight-operations control, e.g., dispatch or flight following?
ii) Does the Company have special dispatch requirements for extended twin-engine operations (ETOPS)?
iii) Are fuel/route requirements determined by the regulatory authority?
iv) If not, what criteria does the company use?
v) Does each crewmember get copies of the pertinent operations specifications?

Operations and Maintenance Training - Training and Checking Standards

i) Does the Company have written standards for satisfactory performance?
ii) Does the Company have a defined policy for dealing with unsatisfactory performance?
iii) Does the Company maintain a statistical database of trainee performance?
iv) Is this database periodically reviewed for trends?
v) Is there a periodic review of training and checking records for quality control?
vi) Are check pilots periodically trained and evaluated?
vii) Does the Company have established criteria for instructor/check-pilot qualification?
viii) Does the Company provide specialised training for instructors/check pilots?
ix) Are identical performance standards applied to captains and first officers?
x) Are training and checking performed by formally organised, independent departments?
xi) How effective is the co-ordination among flight operations, flight training and flight standards?

Operations Training

i) Does the Company have a formal program for training and checking instructors?
ii) Is there a recurrent training and checking program for instructors?
iii) Does the Company have required training and checking syllabi?
iv) Does this training include
  a) Line-oriented flight training (LOFT)?
  b) Crew resource management (CRM)?
  c) Human factors?
  d) Wind shear?
  e) Hazardous materials?
  f) Security?

g) Adverse weather operations?
h) Altitude and terrain awareness?
i) Aircraft performance?
j) Rejected takeoffs?
k) ETOPS?
l) Instrument Landing System (ILS) Category II and Category III approaches?
m) Emergency procedures training, including pilot/flight attendant interaction?
n) International navigation and operational procedures?
o) Standard International Civil Aviation Organisation (ICAO) radiotelephone phraseology?
p) Volcanic-ash avoidance/encounters?

v) If a ground-proximity warning system (GPWS), traffic-alert and collision avoidance system (TCAS) and other special systems are installed, is specific training provided for their use? Are there clearly established policies for their use?
vi) Are English-language skills evaluated during training and checking?
vii) Is English-language training provided?
viii) At a minimum, are the procedures contained in the manufacturer's aircraft operations manual covered in the training program?
ix) Is initial operating experience (IOE) mandated?
x) Is first/second officer IOE required to be conducted "in seat" rather than in the observer's seat?
xi) Are there formal means for modification of training programs as a result of incidents, accidents or other relevant operational information?

Training Devices

i) Are approved simulators available and used for all required training?
ii) Is most of the Company's training performed in the simulator?
iii) Do the simulators include GPWS, TCAS, background communications and other advanced features?
iv) Are simulators and/or training devices configuration-controlled?
v) Has the company established a simulator/training device quality-assurance program to ensure that these devices are maintained to acceptable standards?
vi) Does the regulatory authority formally evaluate and certify simulators?

Flight Attendant Training

i) Do flight attendants receive comprehensive initial and recurrent safety training?
ii) Does this training include hands-on use of all required emergency and safety equipment?
iii) Is the safety training of flight attendants conducted jointly with pilots?
iv) Does this training establish policies and procedures for communications between cockpit and cabin crew?
v) Are evacuation mock-up trainers that replicate emergency exits available for flight attendant training?

Maintenance Procedures, Policies and Training

i) Does the regulatory agency require licensing of all maintenance personnel?
ii) Is formal maintenance training provided by the company for all maintenance personnel? Is such training done on a recurrent basis? How is new equipment introduced?
iii) Does the Company have a maintenance quality assurance program?

iv) If contract maintenance is used, is it included in the quality assurance program?
v) Is hands-on training required for maintenance personnel?
vi) Does the Company use a minimum equipment list (MEL)?
vii) Does the Company's MEL meet or exceed the master MEL?
viii) Does the Company have a formal procedure covering communications between maintenance and flight personnel?
ix) Are "inoperative" placards used to indicate deferred-maintenance items? Is clear guidance provided for operations with deferred-maintenance items?
x) Are designated individuals responsible for monitoring fleet health?
xi) Does the Company have an aging-aircraft maintenance program?
xii) Is there open communication between the maintenance organisation and other operational organisations, such as dispatch? How effective is this communication?
xiii) Does the Company use a formal, scheduled maintenance program?
xiv) Are policies established for flight and/or maintenance personnel to ground an aircraft for maintenance?
xv) Are flight crew members ever pressured to accept an aircraft that they believe must be grounded?
xvi) Are flight crews authorised to ground an aircraft for maintenance?

Scheduling Practices

i) Are there flight- and duty-time limits for pilots?
ii) Are there flight- and duty-time limits for flight attendants?
iii) Do the flight- and duty-time limits meet or exceed FARs/JARs requirements?
iv) Do flight- and duty-time limits apply regardless of the type of operation, e.g., cargo, passenger, ferry, and charter?
v) Does the Company train flight crewmembers to understand fatigue, circadian rhythms and other factors that affect crew performance?
vi) Does the Company allow napping in the cockpit?
vii) Are on-board crew-rest facilities provided or required?
viii) Are there minimum standards for the quality of layover rest facilities?
ix) Does the company have a system for tracking flight-and duty-time limits?
x) Has the company established minimum crew-rest requirements?
xi) Are augmented crews used for long-haul flights?
xii) Are circadian rhythms considered in constructing flight crew schedules?
xiii) Are there duty-time limits and rest requirements for maintenance personnel?

Crew Qualifications

i) Does the Company have a system to record and monitor flight crew currency?
ii) Does the record-keeping system include initial qualification, proficiency checks and recurrent training, special airport qualifications, line-check observations and IOE observations for:
    a) Pilots in command?
    b) Seconds in command?
    c) Flight engineers?
    d) Instructors and check pilots?
    e) Flight attendants?
iii) Does the regulatory authority provide qualified oversight of instructor and check-pilot qualification?
iv) Are the Company's simulator instructors line-qualified pilots?

v) Does the Company permit multiple aircraft qualification for line pilots?
vi) Do Company check-pilots have complete authority over line-pilot qualification, without interference from management?
vii) If the Company operates long-haul flights, does it have an established policy for pilot currency, including instrument approaches and landings?
viii) Does the Company have specific requirements for pilot-in-command and second-in-command experience in type for crew scheduling?

Publications, Manuals and Procedures

i) Are all flight crew members issued personal copies of their type operations manuals/FCOM and any other controlled publications?
ii) How are revisions distributed?
iii) How is the issue and receipt of revisions recorded?
iv) Does the Company have an airline operations manual?
v) Is the airline operations manual provided to each crewmember?
vi) Is the airline operations manual periodically updated?
vii) Does the airline operations manual define:
    a. Minimum numbers of flight crewmembers?
    b. Pilot and dispatcher responsibilities?
    c. Procedures for exchanging control of the aircraft?
    d. Stabilised-approach criteria?
    e. Hazardous-materials procedures?
    f. Required crew briefings for selected operations, including cockpit and cabin crewmembers?
    g. Specific pre-departure briefings for flights in areas of high terrain or obstacles?
    h. Sterile-cockpit procedures?
    i. Requirements for use of oxygen?
    j. Access to cockpit by non-flight crewmembers?
    k. Company communications?
    l. Controlled flight into terrain (CFIT)-avoidance procedures?
    m. Procedures for operational emergencies, including medical emergencies, and bomb threats?
    n. Aircraft de-icing procedures?
    o. Procedures for handling hijacking and disruptive passengers?
    p. Company policy specifying that there will be no negative consequences for go-arounds and diversions when required operationally?
    q. The scope of the captain's authority?
    r. A procedure for independent verification of key flight-planning and load information?
    s. Weather minima, maximum cross- and tail-wind components?
    t. Special minima for low-time captains?
viii) Are emergency escape routes developed and published for flights in areas of high terrain?
ix) Are all manuals and charts subject to a review and revision schedule?
x) Does the company have a system for distributing time-critical information to the personnel who need it?
xi) Is there a company manual specifying emergency-response procedures?
xii) Does the company conduct periodic emergency-response drills?
xiii) Are airport-facility inspections mandated by the company?
xiv) Do airport-facility inspections include reviews of Notices To Airmen (NOTAMs)?
    a. Signage and lighting?

b. Runway condition, such as reverted rubber accumulations, foreign object damage (FOD), etc.?
c. Crash, fire and rescue availability? Navigational aids (NAVAIDS)?
d. Fuel quality?

Dispatch, Flight Following and Flight Control

i) Does initial/recurrent dispatcher training meet or exceed FARs/JARs requirements?
ii) Are operations during periods of reduced crash, fire and rescue (CFR) equipment availability covered in the company flight operations manual?
iii) Do dispatchers/flight followers have duty-time limitations?
iv) Are computer-generated flight plans used?
v) Are ETOPS alternates specified?

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APPENDIX E

RISK MANAGEMENT PROCESS

APPENDIX E TABLE OF CONTENTS

E.1 GENERAL

E.1.1 This section is an overview of risk management theory. It is intended as a treatise to provide the background material necessary to understand the risk management process. This section does not necessarily describe how to implement a risk management programme.

E.1.2 There will always be hazards, associated with the operation of any aircraft. Technical, operational and human errors induce the hazards. Hazards are the contributors to accidents. Accidents are the result of many contributors. Risk is the likelihood and severity of the specific potential accident. The aim of every flight safety programme therefore is to identify, eliminate, and control risks and associated hazards. **This is achieved by hazard analysis and the careful recording and monitoring of safety-related occurrences for adverse trends in order to prevent the recurrence of similar incidents which could lead to an aircraft accident**.

E.1.3 Hazard analysis is the application of methods to identify hazards and evaluate associated risks. The functions, operations, tasks, steps, and criteria for design are evaluated to identify hazards and their risks.

E.1.4 The purpose of internal feedback and trend monitoring programmes is to allow managers to assess the risks involved in the operations and to determine logical approaches to counteract them. There will always be risks in aviation operations. Some risks can be accepted. Some, but not all, can be eliminated. Others can be reduced to the point where they are acceptable. Decisions on risk are managerial; hence the term “risk management.”

E.1.5 Risk management decisions follow a logical pattern. The first step is to accurately identify the hazards. The second step is to assess the hazards in the order of their risk potential and determine whether the organisation is prepared to accept that risk. The crucial points are the will to use all available information and the accuracy of the information about the hazards, because no decision can be better than the information on which it is based. The third step is to find and identify the defences that exist to protect against or control the hazards or even eliminate them. Step four is then to assess the defences for their effectiveness and consequences. Finally, as step five, each set of hazards needs to be critically examined to determine whether the risk is appropriately managed and controlled. The objective is to reduce the probability that a particular hazard will occur, or reduce the severity of the effects if it does occur. In some cases, the risk can be reduced by developing means to cope safely with the associated hazards.

E.1.6 In large organisations, such as airlines, the costs associated with loss of human life and physical resources mean that risk management is essential. To produce recommendations that coincide with the objectives of the organisation, a systems approach to risk management must be followed. Such an approach, in which all aspects of the organisation's objectives and available resources are analysed, offers the best option for ensuring that recommendations concerning risk management are realistic.

E.1.7 The system approach to risk management is known as system safety. It is the application of engineering and management principles, criteria, and techniques to optimise safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle. A system could be any entity, at any level of complexity, of personnel, procedures, materials, tools, equipment, facilities, aircraft, and software.

E.2 HAZARD IDENTIFICATION AND ANALYSIS

E.2.1 The objective of The Hazard Identification and Risk Analysis process is to provide the Company with a technique for early identification of the risks to which it is exposed. The technique should initially be applied retrospectively throughout the Company and then during the early stages of any new venture undertaken to provide essential information for project development decisions. By this process, safer and more efficient options can be adopted from the outset, minimising the later exposure to litigation, disruption and increased costs.

The benefits include:

- Opportunity to identify specific hazards and risks within a projects life-cycle
- Potential to review operating philosophies at an early stage before significant financial commitments are made
- Identifying differences from the level of standardisation already established
- Enhancing the existing procedures by identifying their latent risks
- Targeting expenditure in a structured way to improve safety and efficiency

E.2.2 The technique can also be used within the financial arena to concentrate expenditure in the areas designated as providing maximum benefit, in accordance with the Company philosophy and requirements. At times of expansion these requirements and priorities may be vastly different to those in recession.

E.2.3 An effective hazard identification system is characterised as being non-punitive, confidential, simple, direct and convenient. It should have an identifiable process for both action and feedback.

E.2.3 A hazard can be defined as the potential for harm, both unsafe acts and/or conditions that can result in accidents. There can be many contributory hazards associated with a potential accident or a specific risk.

E.2.5 The degree of risk is based on the likelihood that damage or harm will result from the associated hazards and the severity of the consequences.

E.2.6 Hazard identification and risk management should be undertaken:

- During implementation of the safety program and then on a frequent basis depending of the complexity of operations and associated risks
- When changes are planned. If the organisation is undergoing rapid change, such as rapid growth and expansion, new route structures or acquisition of other aircraft types, new systems

E.3 RISK MANAGEMENT PROCESS

3.3.1 The process of risk management can be divided into the following five steps:

E.3.1.1 Identify the Hazards

There are many ways of identifying hazards and quantifying risks, but success requires lateral thinking by people who are unencumbered by past ideas and experiences. The hazards of an operation may be obvious, such as lack of training, or they may be subtle, such as the insidious effects of long-term fatigue.

Each hazard, once identified, should be recorded without fear or favour.

Depending on the size and complexity of your operation, there are several useful methods of identifying hazards:

- Brainstorming - small discussion groups meet to generate ideas in a non- judgmental way
- Formal review of standards, procedures and systems
- Staff surveys or questionnaires
- One person standing back from the operation and critically watching
- Internally or externally conducted safety assessments
- Confidential reporting systems

Formal methods and techniques can be applied such as, system safety analysis, job safety analysis, energy trace and barrier analysis, procedure analysis checklists, and task analysis. There are a number of appropriate references for sources of analysis methods and techniques.[1]

Small operator:
The small non-commercial operator simply needs to apply discipline and allocate time to critically look at all facets of the company's operations and systems, and identify the hazards. You need to take action to either eliminate the hazards where possible, or vary the operation, or change a design in some practical way that will offer protection from the hazards and there associated risks in order to ensure acceptable risk.

Medium-large operator/airline:
Establishing discussion groups with as many staff and line managers as practical is a good method to identify hazards. The group discussions will also encourage staff to become more actively involved in establishing your safety program.

The purpose of the discussion groups is to provide a structured method of identifying those hazards and risks, which are most likely to cause injury or damage. The number of participants will depend on the size of the organisation, probably three or four for a medium company and up to eight people for a regional airline.

It is a good idea to have a number of groups each representing the various functional areas, i.e. flight operations, ground crew, maintenance and engineering, pilots and cabin crew. Each group should run with participants from the same functional area, e.g. all pilots or all engineers, and so on.

[1] Hazard Analysis Handbook, International System Safety Society 2nd Edition.

One example of a system for proactively identifying hazards is the BASI-INDICATE program. It describes how to set up groups and conduct a basic process for identifying safety hazards by following five simple steps:

- Identify potential airline hazards that may threaten the safety of passengers
- Rank the severity of hazards
- Identify current defences
- Evaluate the effectiveness of each defence
- Identify additional defences.

E.3.1.2 Assess The Hazards

The next step in the process is to critically assess the hazards and rank risks. Factors to consider are the likelihood of the occurrence and the severity of the consequences.

For example; an extensive in-flight fire may be an unlikely occurrence which would be catastrophic if it were to occur. It would rank above a bird strike which, although much more likely to occur, may be less severe. There are various ways of doing this type of assessment. They range from the subjective to the very analytical and objective.

E.3.1.3 Identify The Defences

Once the hazards are identified and their risks approximately ranked, the defences (hazard controls) which exist to protect against the hazards should be identified.
Examples:

- A defence against an in-flight fire may be a fire extinguisher
- A defence against particular hazards would be to ensure that operating procedures are properly documented and implemented with compliance
- Automated caution and warning systems and contingency response

E.3.1.3 Assess The Defences

The appropriateness of hazard controls is then assessed. How effective are the hazard controls? Would they prevent the occurrence (i.e. do they remove the hazard), or do they minimise the likelihood or the consequence? If the latter, to what extent is this true? An example of determining the effectiveness of a hazard control is to ask the question: Does the crew know how to use the fire extinguishers and are the extinguishers correctly maintained?

E.3.1.5 Identify The Need For Hazard Elimination And Avoidance Or For Further Defences

Finally, each hazard and its hazard control need to be critically examined to determine whether the risk is appropriately managed or controlled. If it is, the operation may continue. If not, then steps should be taken to improve the hazard control or to remove or avoid the hazard. For example, an operator may provide recurrent training for crew in the correct use of fire extinguishers. In some instances, a range of solutions to a risk may be available. Some are typically engineering solutions (e.g. redesign) which are generally the most effective, but may be expensive. Others involve control (e.g. operating procedures) and personnel (e.g. training) and may be less costly. In practice, a balance needs to be found between the cost and practicality of the various solutions.

At this point, all the Flight Safety Officer or the safety action group may be able to do is to recommend change or action to the CEO. Whether or not the recommendation is acted upon needs to be monitored and a further cycle of risk management carried out.

E.3.2 Understanding System Complexities

E.3.2.1 Within the past few years' complex systems have evolved into sophisticated automated systems with many interactions and interfaces. These systems can be comprised of vast sub-systems of hardware, firmware, software, electronics, avionics, hydraulics, pneumatics, biomechanics, ergonomics, and human factors. There are further complications involving other considerations, like the potential for management oversight and the perception of risk. A more complete paradigm of a system risk should consider all of these complexities.

E.3.3 System Risks

E.3.3.1 Consider a system as a composite, at any level of complexity. The elements of this composite entity are used together in an intended environment to perform a specific objective. There can be risks associated with any system and complex technical systems are everywhere within today's modern society. They are part of every day life, in transportation, medical science, utility, nuclear power, general industry, military, and aerospace. These systems may have extensive human interaction, complicated machines, and environmental exposures. Humans have to monitor systems, pilot aircraft, operate medical devices, and conduct design, maintenance, assembly and installation efforts. The automation can be comprised of extensive hardware, software, and firmware. There are monitors, instruments, and controls. Environmental considerations can be extreme: harsh climates, outer space, and ambient radiation. If automation is not appropriately designed, potentially unacceptable system risks or system accidents can result.

E.3.3 System Accidents

E.3.3.1 System accidents may not be the result of a simple single failure, or a deviation, or a single error. Although simple adverse events still do occur, system accidents are the result of many contributors, combinations of errors, failures, and malfunctions. It is not easy to see the *system picture* or to *connect the dots* while evaluating multi-contributors within adverse events, identifying initial events, and subsequent events to the final outcome. System risks can be unique, undetectable, not perceived, not apparent, and very unusual. A novice investigator, analyst, or outside party can question the credibility of such diverse events.

E.3.3.2 Determining potential event propagation through a complex system can involve extensive analysis. Specific reliability and system safety methods such as software hazard analysis, failure modes and effects analysis, human interface analysis, scenario analysis, and modelling techniques can be applied to determine system risks, which can be the inappropriate interaction of software, human, machine, and environment.

E.3.5 Risk Identification

E.3.5.1 The overall system objective should be to design a complex system with acceptable risks. Since Reliability is the probability that a system will perform its intended function satisfactorily, these criteria should also address the safety-related risks, which directly equate to failures or the unreliability of the system. This consideration includes hardware, firmware, software, humans, and environmental conditions.

E.3.5.2 From a system safety view, the problem of risk identification becomes even more complex, in that the dynamics of a potential system accident are also evaluated. When considering multi-event logic determining quantitative probability of an event becomes extensive, laborious, and possibly inconclusive. The model of the adverse event below, Figure E.1, represents a convention (an estimation) of a potential system accident with the associated top event --- the harm expected, contributory hazards, less then adequate controls, and possibly less then adequate verification. The particular potential accident has a specific initial risk and residual risk.

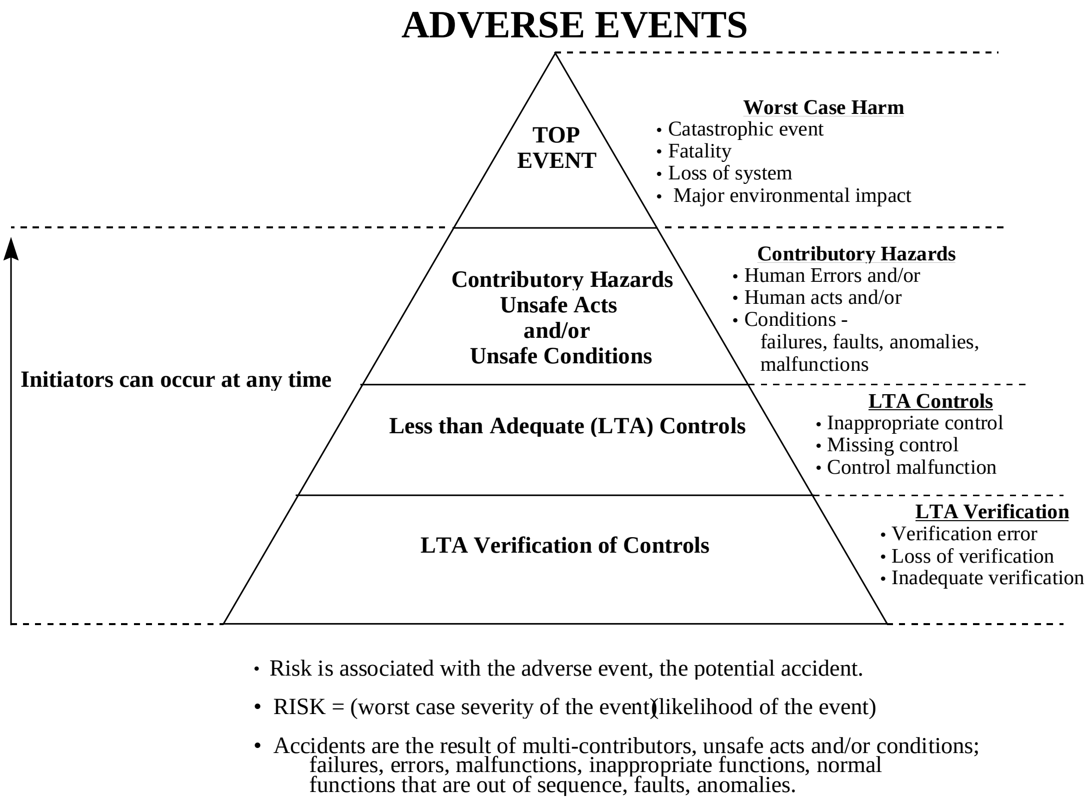


Figure E.1

E.3.5.3 Risk is an expression of probable loss over a specific period of time or over a number of operational cycles. Risk is comprised of two major potential accident variables, loss and likelihood. The loss relates to harm, or severity, or consequence. Likelihood is more of a qualitative estimate of loss. Likelihood estimates can be inappropriate since specific quantitative methods can be questionable considering mathematical debate and the lack of relative appropriate data. There are further contradictions, which add to complexity when multi-event logic is considered. This logic includes event flow, initiation, verification/control/hazard interaction, human response, and software error.

E.3.5.4 The overall intent of system safety is to prevent the potential system accidents by the proactive elimination of associated risk, or controlling the risk to an acceptable level. One point is that reliance on probability as the total means of controlling risk can be inappropriate.

Figure E.2 illustrates multi-event logic.

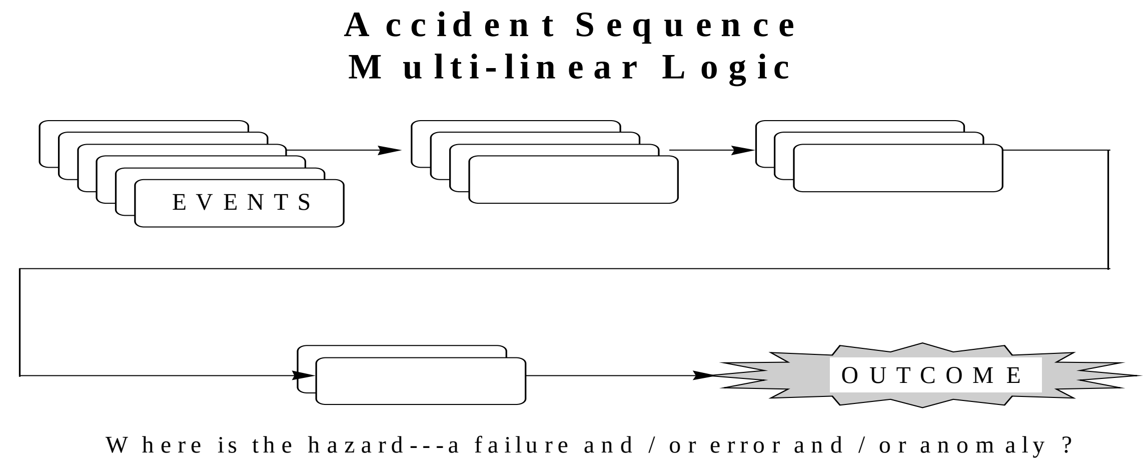


Figure E.2

E.3.6 Risk Control

E.3.6.1 The concept of controlling risk is not new. Lowrance[2], in 1935, had discussed the topic. It has been stated that…"a thing is safe if the risks are judged to be acceptable." The discussion recently has been expanded to the risk associated with potential system accidents --- system risks. Since risk is an expression of probable loss over a specific period of time, two potential accident variables, loss and likelihood can be considered the parameters of control. To control risk either the potential loss (severity or consequence) or its likelihood is controlled. A reduction of severity or likelihood will reduce associated risk. Both variables can be reduced or either variable can be reduced, thereby resulting in a reduction of risk.

E.3.6.2 The model of an adverse event, above, is used to illustrate the concept of risk control. For example consider a potential system accident where reliability and system safety design and administrative controls are applied to reduce system risk. There is a top event, contributory hazards, less then adequate controls, and less then adequate verification. Controls can reduce the severity and / or likelihood of the adverse event.

E.3.6.3 For discussion, consider the potential loss of a single engine aircraft due to engine failure. Simple linear logic would indicate that a failure of the aircraft's engine during flight

[2] Lowrance, William W., Of Acceptable Risk --- Science and the Determination of Safety, 1935, Copyright 1976 by William Kaufmann, Inc.

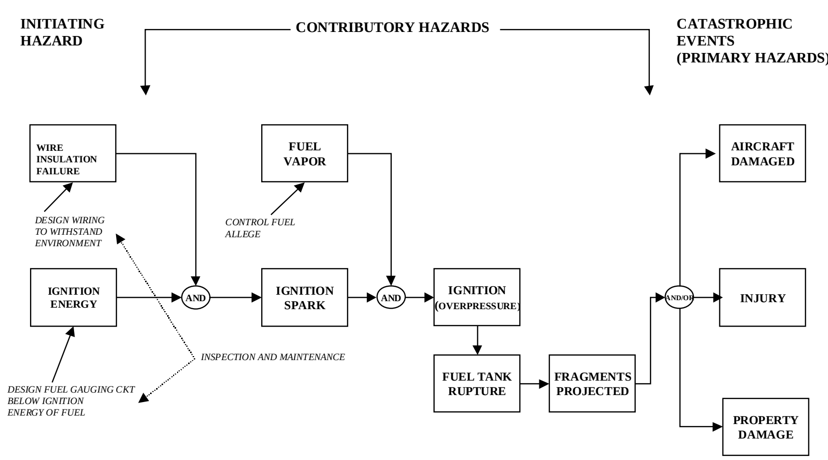
would result in possible uncontrolled flight into terrain. Further multi-event logic which can define a potential system accident would indicate additional complexities; loss of aircraft control due to inappropriate human reaction, deviation from emergency landing procedures, less then adequate altitude, and /or less then adequate glide ratio. *The reliability-related engineering controls in this situation would be just as appropriate to system safety. Consider the overall reliability of the engine, fuel sub-systems, and the reliable aerodynamics of the aircraft.* The system safety related controls would further consider other contributory hazards: inappropriate human reaction, and deviation from emergency procedures. The additional controls are administrative in nature: the design of emergency procedures, training, human response, communication procedures, and recovery procedures.

E.3.6.4 In this example, the controls above would decrease the likelihood of the event and possibly the severity. The severity would decrease as a result of a successful emergency landing procedure, where the pilot walks away and there is minimal damage to the aircraft.

E.3.6.5 This has been a review of a somewhat complex potential system accident. The hardware, the human, and the environment were evaluated. There would be additional complexity if software were included in the example. The aircraft could have been equipped with a fly-by-wire flight control system or an automated fuel system.

E.3.6.6 A number of examples are provided below in the following illustrations (Figures E.3 - E.5). Each illustration shows an actual system accident that has occurred. Their initiating hazards, contributory hazards, and primary hazards are indicated along with appropriate controls. These sorts of flow diagrams are helpful in conducting hazard analysis or accident reconstruction.

WHERE IS THE SINGLE HAZARD?



SEQUENCES OF EVENTS THAT COULD CAUSE AN ACCIDENT FROM A FUEL TANK RUPTURE, AND POSSIBLE SAFEGUARDS.

Figure E.3

WHERE IS THE SINGLE HAZARD?

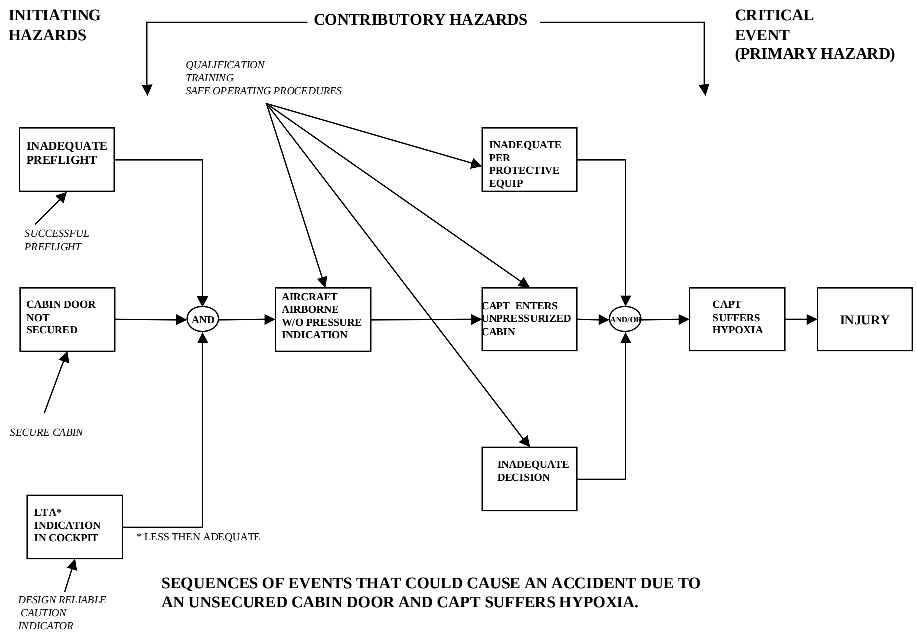


Figure E.4

WHERE IS THE SINGLE HAZARD?

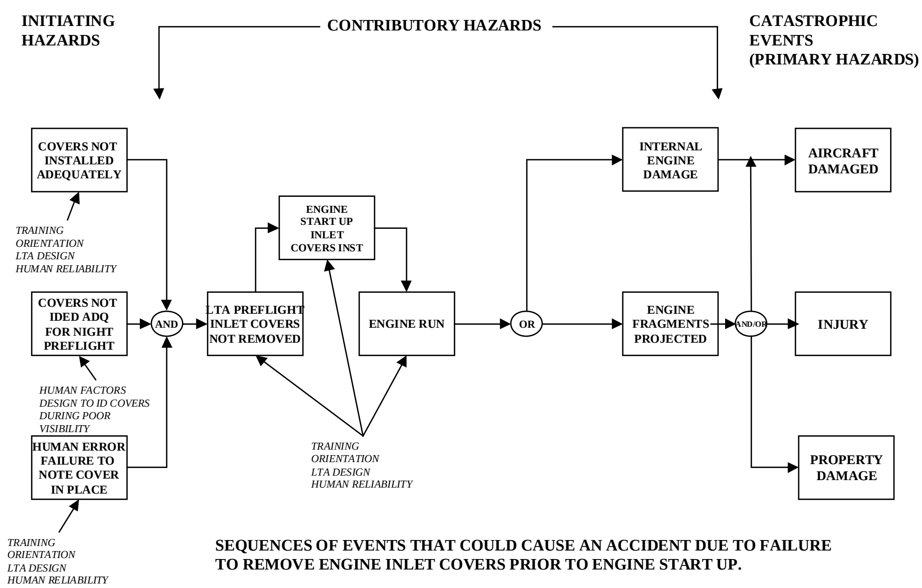


Figure E.5

E.3.7 Risk Analysis Matrix

E.3.7.1 Using the Risk Analysis Matrix, it is possible to standardise the qualitative risk assessments, and categorise the hazards using the criteria the Company considers important. The matrix axes, consistent with the definition of risk, are Consequences and Probability. The consequences are ranked in increasing severity from 0 to 5 in the categories considered to be important to the Company and the probability is ranked in increasing probability from A to E. A typical risk assessment matrix is shown in Figure E.6.

Risk Analysis Matrix

Severity	Consequence					Increasing Probability				
	People	On Time Dep.	Assets	Environment	Reputation	A	B	C	D	E
	P	T	A	E	R	Never heard of in the industry	Has occurred in the industry	Has occurred in BM	Has occurred several times in the industry	Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact	Low				
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 to 2 Hours	Major damage	Localised effect	Considerable impact			Medium		
4	Single fatality	2 to 4 hours	extensive damage	Major effect	National impact					
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact					High

Figure E.6

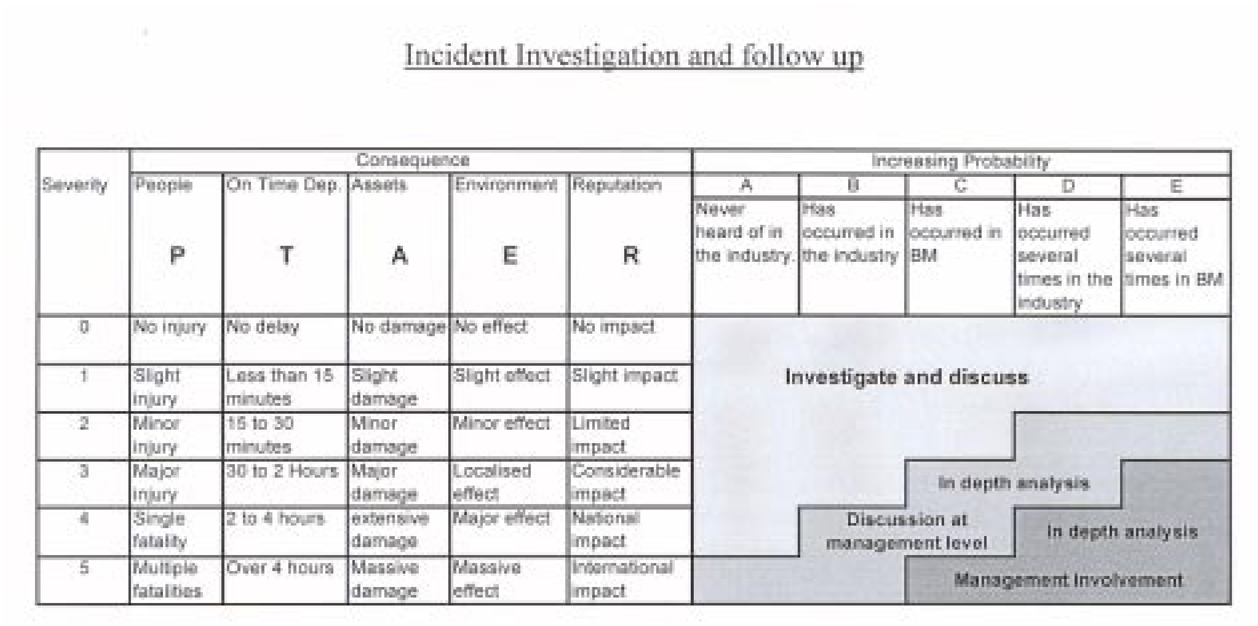
The Risk Analysis Matrix places the five categories at different levels of severity and in various degrees of probability, because it relates to the probability of the estimated potential consequences occurring. The degree of severity can also be set to reflect different requirements, such as company strategy and policy, Figure 3.7, or incident investigation and follow up requirements, Figure 3.8.

Company Strategy and Policy

Severity	Consequence					Increasing Probability				
	People	On Time Dep.	Assets	Environment	Reputation	A	B	C	D	E
	P	T	A	E	R	Never heard of in the industry	Has occurred in the industry	Has occurred in BM	Has occurred several times in the industry	Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact	Manage for continuous improvement				
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 to 2 Hours	Major damage	Localised effect	Considerable impact				Reduce risk	
4	Single fatality	2 to 4 hours	extensive damage	Major effect	National impact		Demonstrate ALARP			
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact					Intolerable

(ALARP: *As Low As Reasonably Practicable*)

Figure E.7



Incident Investigation and follow up

Severity	Consequence					Increasing Probability				
	People	On Time Dep.	Assets	Environment	Reputation	A	B	C	D	E
	P	T	A	E	R	Never heard of in the industry.	Has occurred in the industry	Has occurred in BM	Has occurred several times in the industry	Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact					
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 to 2 Hours	Major damage	Localised effect	Considerable impact					
4	Single fatality	2 to 4 hours	extensive damage	Major effect	National impact					
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact					

Figure E.8

E.3.8 Safety Precedence Sequence

E.3.8.1 A fundamental concept of hazard control is the Safety Precedence Sequence. The most effective way to control identified hazards is to eliminate them through design or engineering changes. If this is not possible or practical, the next course of action should be to use physical guards or barriers to separate potential unwanted energy flows or other hazards from potential targets. Warning devices should next be applied to any remaining hazards. As a last resort, after other methods have been exhausted, procedures and training should be used.

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APPENDIX F

CORPORATE AVIATION DEPARTMENT

ACCIDENT RESPONSE TEAM

GUIDELINE EXAMPLE

"C.A.R.E."

APPENDIX F TABLE OF CONTENTS

There are many examples of accident response checklists available for use by the operator. One example is covered here to illustrate the basic requirements for response. It uses the acronym "CARE, for Confirm, Alert, Record, Employee.

C - Confirm

- Get the name, entity, telephone number, fax number and address of the person calling-in the report.
- Try to make certain the caller is not perpetrating a hoax by calling him/her back. If necessary, verify the entity's phone number with long distance information.
- Presume anonymous calls regarding threats of sabotage or hostages as genuine. Try to record the exact words of the caller. Listen for identifiable background noise.
- If the call is from a foreign country, verify the caller's entity with the respective embassy of that country.
- Note the date and time of the accident/occurrence and the time you received notification.
- Obtain as much information from the caller as possible. For example:
    - Make and model of aircraft
    - Aircraft Registration number
    - Location of the accident or occurrence
    - Medical condition of persons involved
    - Names of the health care facilities providing treatment
    - Extent of damage to the aircraft
    - Whether police, fire, rescue or regulatory authority are enroute or on the scene
    - Whether other government agencies have been notified

A - Alert

- Assess whether the accident or occurrence requires activating the complete Response Plan.
    - Refer to investigative authority recommendations (i.e. NTSB regulation Part 830)
    - Refer to any applicable corporate policies
    - Refer to your aircraft insurance policy
- Consider possible modifications to this Plan to meet the needs of the situation.
- Call the next primary or alternate member (the Senior Executive) of your Response Team.
- You will receive a confirmation call from the last Team member informing you of the name and phone number of each Team member notified.
- Instruct Switchboard Operators to direct incoming phone calls related to the accident to your location. Calls from the media should be directed to the Senior Executive or Public Relations Representative.
- Notify the regulatory and investigative authorities. For criminal acts such as sabotage, hostages or a bomb threat, notify the criminal authorities.
- Simply give the facts. Do not speculate or draw your own conclusions to explain anything.
- Contact law enforcement officials at the scene and, if necessary, authorise use of off-duty police for site security.
- Confirm the passenger/crew manifest. Obtain an accurate list of passengers and crewmembers involved in the accident from the Team Leader or flight department scheduler. Verify exact names, employers and contact telephone numbers.
- The Risk Manager will receive notification of the accident through this Plan. If your company does not have a Risk Manager, notify your aviation insurance broker and the field claims office nearest to the accident site.
- Carefully consider the advice of your aviation insurance claims professional.

- Contact those individuals who were to meet the aircraft at its intended destination. If the aircraft's destination was home base, co-ordinate with your Human Resources Specialist for family notification and arrangements.
- Make arrangements for the preservation of any wreckage.
- If you contract with an in-flight medical service, have them contact the hospital with passenger and crew medical histories.
- Ensure that crewmembers involved in the accident or occurrence receive medical evaluations as soon as possible and be sure a physician documents their condition.

R - Record

- Retrieve the following original records, make copies for your own purposes and store the originals in a secure place for future reference or use by the regulatory or investigative authorities:
    - Weather reports for the airports closest to the location of the occurrence (METARs, terminal forecasts, Airmets, Sigmets, Notams)
    - All trip papers related to the aircraft and its flight, including weight and balance calculation
    - All personnel and training records for crew members involved, including pilot duty and rest records
    - All maintenance records, including airframe and engine logs and aircraft maintenance log sheets
- Have the Fixed Base Operator (FBO) who last fuelled the aircraft collect a fuel sample.

E - Employees

- Inform flight department employees in person, if possible. If expediency is necessary, inform them via telephone. Do not leave a message other than for a return call.
- Do not inform other flight crews while they are flying. Wait until they arrive at their next destination.
- Advise employees not to discuss the accident with anyone outside the company, including the regulatory and investigative authorities or law enforcement, unless directed to do so by a company superior.
- Consider having the flight department "stand down" by giving employees one or more days off. This time-off may help employees with their emotional state.
- Assure employees this is not a disciplinary measure but is standard procedure for situations like this.
- Use this time to evaluate whether a company flight or maintenance procedure might have contributed to the cause of the accident.
- Use airlines or charters for flight schedules during this time.
- Consider sending your specially trained company representative to the accident site. *Note: Within the United States, it is within the discretion of the NTSB investigator-in-charge to allow participation in the field investigation by the companies whose employees, functions, activities or products were involved in the accident or incident and who can provide suitable qualified technical personnel to assist in the field investigation (49 CFR 831.11).* Dispatch that individual to the accident site. Have that person inform the local law enforcement, regulatory and investigative authorities and your aviation insurance claims specialist that he or she is on-scene as your company representative.
- If permitted by the investigator-in-charge, photograph the damaged aircraft and the scene.
- Keep your Team's Legal Representative informed on the status of your actions.

APPENDIX G

HANDBOOK

SOURCE MATERIAL

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HANDBOOK SOURCE MATERIAL

1. *Flight Safety Manager's Handbook*, Airbus Industrie, Issue 1 March 99
2. *Airbus Industrie Safety Strategy*
3. *Guide to an Aviation Safety Management System,* UK Flight Safety Committee
4. *Aviation Safety Management System Implementation Document,* UK Flight Safety Committee
5. *Policy Document, Aviation Safety Management System,* UK Flight Safety Committee
6. *Aviation Safety Management, An Operator's Guide to Building a Safety Program*, Civil Aviation Safety Authority Australia, April 1998
7. *Proactively Monitoring Airline Safety Performance: INDICATE,* Bureau of Air Safety Investigation, Australia, October 1996.
8. *The BASI-INDICATE Safety Program, Implementation Guide,* Bureau of Air Safety Investigation, Australia, January 1998
9. *An Evaluation of the BASI-INDICATE Safety Program,* Bureau of Air Safety Investigation, Australia, 1998
10. *Corporate Aircraft Accident Response Plan,* United States Aircraft Insurance Group, 1996 - 1999
11. *The Dollars and Sense of Risk Management and Airline Safety,* Flight Safety Foundation Flight Safety Digest, December 1994
12. *Aviation Safety: Airline Management Self-Audit,* Flight Safety Foundation Flight Safety Digest, November 1996
13. *The Practice of Aviation Safety, Observations from Flight Safety Foundation Safety Audits,* Flight Safety Foundation, June 1990
14. *Safety Program Model,* Boeing Commercial Airplane Group
15. *Air Carrier Safety Departments, Programs, and the Director of Safety,* FAA Bulletin HBAT 99-19 and HBAW 99-16, November 30, 1999.
16. *Air Carrier Internal Evaluation Programs,* FAA Advisory Circular 120-59, October 26, 1992.
17. *Dupont Corporate Culture Policy Statement;* Dupont Aviation, letter dated March 11, 2000.
18. *FAA System Safety Handbook, Draft*; FAA Office of System Safety, ASY-300, Washington, DC, February 2000.

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APPENDIX H

HANDBOOK

FEEDBACK FORM

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HANDBOOK FEEDBACK FORM

The GAIN Working Group A encourages the submittal of any comments and/or suggestions that will improve upon the content of this handbook for future revisions. Please submit this form to:

GAIN Working Group A
c/o Abacus Technology Corporation
5454 Wisconsin Ave NW
Suite 1100
Chevy Chase, MD 20815
USA
Fax: +1 (703) 907-0036

or email this form to:

GAINweb@abacustech.com

Name: ______________________________________

Title: ______________________________________

Company: ____

Mailing Address: ____

____

Phone & Fax Numbers: ____

Email: ____

1. Do you feel the handbook is complete? Yes______ No ______

Suggestions for additional material to be include in future issues:__________________________

____

____

2. Was the handbook a valuable asset in carrying out your duties? Yes _____ No _____

Details:____

____

3. Was there any material you felt should not have been included in the handbook?
Yes_____ No _____

Details: ____

____

____

4. Would you recommend this handbook to colleagues and other professionals in the industry? Yes _____ No _____

5. Additional comments:

Thank you for providing your valuable inputs.

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